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ABSTRACT

Six lessons for students in grades K-3 and six lessons for students in grades 4-6 are presented. These lessons are designed to help students become more aware of the energy choices that they must make in the present and for the future and to understand that the costs of maintaining a specific standard of living and thriving national economy can be controlled with wise energy choices and decisions. Each lesson includes: statement of concept(s) fostered; time requirement; list of materials needed; rationale; instructional objectives; suggested teaching procedure; suggested evaluation strategy; additional activities; and (when applicable) student handouts, worksheets, and transparency masters. Concepts fostered in the lessons are: productive and natural resources; productive resources (labor, capital, natural resources); consumption; opportunity cost; decision-making, and costs and benefits; and opportunity cost. Included is a list of free and inexpensive materials by these subject areas: coal; conservation; economics and energy; electricity; energy (general); energy education; environment; natural gas; nuclear energy; petroleum; renewable energy sources; and synthetic fuels. Also included is a glossary of important energy and economics terms. (JN)

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Energy and Economics

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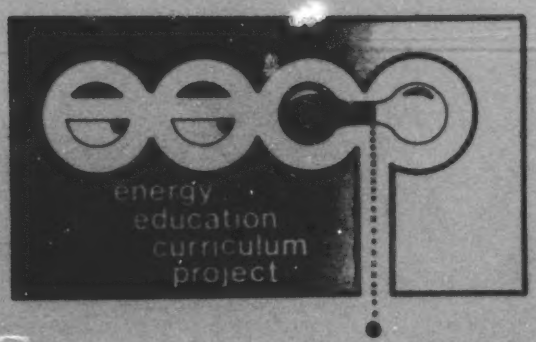

for the Elementary Grades

Division of Energy Policy
Indiana Department of Commerce
Lt. Governor John Mutz, Director

Indiana Department of Public Instruction
Harold H. Negley, Superintendent

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ENERGY AND ECONOMICS

UNIT I (GRADES K-6)

LESSONS AND ACTIVITIES FOR THE ELEMENTARY GRADES

Division of Energy Policy
Indiana Department of Commerce
Lt. Governor John Mutz, Director

Division of Curriculum
Indiana Department of Education
Harold H. Negley, Superintendent

May 1984

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Dr. Peter Harrington assisted with the review process which was completed by teachers who participated in the Economics of Energy Workshops. These materials have been revised based upon the comments and suggestions of the teachers.

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Community Workers and the Energy They Use - A product of the National Science Teachers Association (NSTA) for the Department of Energy, Washington, D.C. 20585.

Energy Trade Offs in the Marketplace
Washington State Council on Economic Education
Office of the Superintendent of Public Instruction
Olympia, Washington 98504

The Energy We Use - A product of NSTA for the Department of Energy.

The Best Present of All
Oliver A. Houck
Tulane Law School
Tulane University
New Orleans, LA 70118

The Energy 80 Resource Book, Volume 3, "Teaching About Energy", Unit 7; (c) 1982 Enterprise for Education, Inc. (Permission granted to individual teachers to reproduce the student handout, "Other Uses for Resources That Could Be Used to Get Energy," for classroom use. Lesson 1-6.)

Enterprise for Education, Inc.
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Santa Monica, CA 90401

The Child's World of Choices
John H. Kilgore
Des Moines Public Schools
and
Donald G. Davison
University of Iowa
Iowa City, IA 52242

The Energy Dome - A social studies packet for grades 4, 5, 6 prepared by NSTA for the Department of Energy.

Energy Curriculum for the Primary Grades
Pennsylvania Department of Education
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Economics: Meeting People's Needs - George G. Watson, Jr., et.al. (c) 1979.

Science Research Associates, Inc.
155 North Wacker Drive
Chicago, IL 60606

Looking for Energy? A Guide to Information Resources

American Petroleum Institute
2101 L Street, Northwest
Washington, D.C. 20037

INTRODUCTION

Energy education is the attempt to resolve the conflict between our present life style and the energy costs in both dollars and resources to produce and maintain that life style.

Working knowledge of basic economics concepts can assist in developing the necessary understanding and decision-making skills inherent in dealing with the changing energy situations.

These lessons have been designed to help students in becoming more aware of the energy choices that they must make in the present and for the future. The costs of maintaining a specific standard of living and a thriving national economy can be controlled with wise energy choices and decisions. The energy and economic concepts contained in these lessons can help students in making those choices.

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FREE AND INEXPENSIVE RESOURCES ON ENERGY AND ECONOMICS

GLOSSARY

LESSON 1-1: OUR CURRENT ENERGY SOURCES

CONCEPT: Productive resources/natural resources

RECOMMENDED USE: Grades K-3

TIME REQUIRED: 2-3 class periods

MATERIALS REQUIRED: Transparency showing examples of natural resources used in Step C
Student handout
You will need your own pictures (see Step D)
Students will need scissors, glue and crayons
Blackline masters provided.

RATIONALE:

As background for understanding our current energy situation, it is important for students to know something about our major current energy sources.

Before goods (e.g., gasoline or electricity) and services can be consumed, they must be produced. For this to happen productive resources are necessary. Productive resources constitute the input of production.

Natural resources are one type of productive resource. They are elements of the natural environment that are used to produce goods and services and thereby help people meet their needs.

Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify the characteristics of a natural resource;
2. distinguish between examples and non-examples of a natural resource;
3. list the 3 natural resources that are currently our main energy sources.

SUGGESTED TEACHING PROCEDURE:

A. Introduce this lesson as follows: "We all use energy products like gasoline, heating oil, and electricity. We use these products to warm and light up places. We use them to move us from one place to another. Before we can use these products, however, they must be made. Gasoline, electricity, and heating oil are made from things that come from nature. We call these things that come from nature "natural resources."

B. If appropriate, write the words "natural resource' on the chalkboard. Tell students that a natural resource is something that people take from nature. People use natural resources to make products that they need, like electricity, gasoline and heating oil.

C. Then give some examples using the pictures included in this lesson. Say something like:

A tree is a natural resource. People take trees from nature. What are some of the things that people make from trees?

Gold is a natural resource. People take it from nature. What are some of the things that gold is used to make?

Is a tornado a natural resource? It does come from nature. But it is not used to make anything that people need. So it is not a natural resource.

Is a bicycle a natural resource? It is not taken from nature. It is made from natural resources. It is a product.

D. Place pictures of examples and non-examples of natural resources, that you have collected, into a box. Be sure that all pictures are mixed together. Have students pull pictures from the box and identify them as either showing a natural resource or as showing something else.

NOTE: Remember that natural resources are things people take from nature that they use to make things they need. So non-examples of natural resources could be: 1) things from nature not used to make products people need--like locusts, hail, earthquakes, etc.; 2) things that are made from natural resources--any kind of product.

E. To complete this section of the lesson, have the class create a collage of pictures portraying natural resources.

F. Next say "Natural resources are used to make gasoline, heating oil, electricity and other energy products. But which natural resources are used?" Distribute the student handout. Then say "This handout shows the natural resources most often used to make energy products in this country." Ask how many different natural resources are used to make energy products?" (Students should respond - 5.)

Then as a class examine the pictures. For each picture you should identify the natural resource shown, describe it briefly and have students color it in a distinctive way (water-blue, coal-black, for example) before moving on to the next picture.

G. Have students cut out the pictures (already colored in), arrange them from largest to smallest, and glue them to a piece of paper. End the lesson by saying, as students look at their papers, that most of the energy products that we use are made from oil, then natural gas, and third from coal. Very little of the energy that we use is made from water. (You may have to explain that water is used to make electricity.)

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define natural resource. Have them give an example.

2. Show students pictures similar to those collected for Step D above. Have students identify which pictures show natural resources.

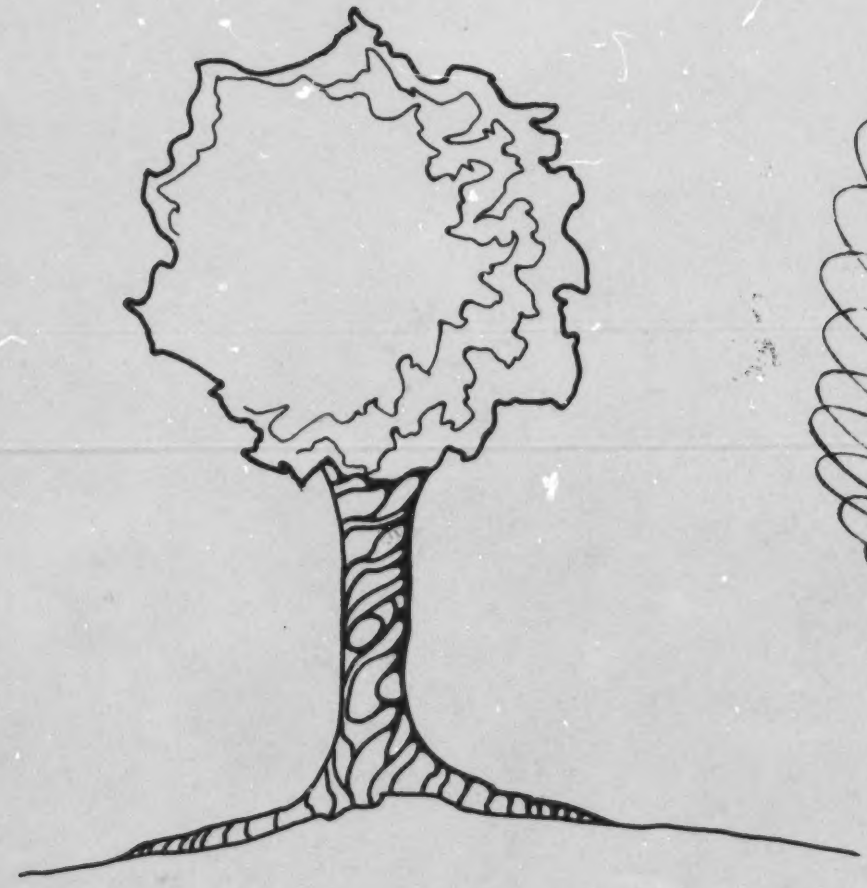
3. Show students pictures of several natural resources that are used to make energy products. Have them identify three that are major sources of energy at the present time.

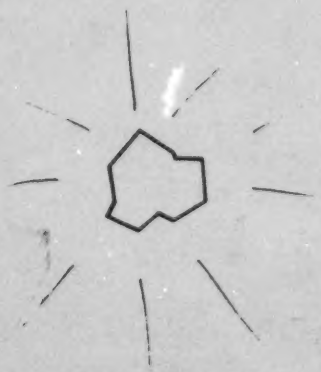
SPIN OFF:

Tell students that 100 years ago only wood and coal were used to make energy. Ask them to imagine and then draw pictures to show what our lives would be like now if the only natural resources available to make energy products were wood and coal.

TRANSPARENCY MASTER

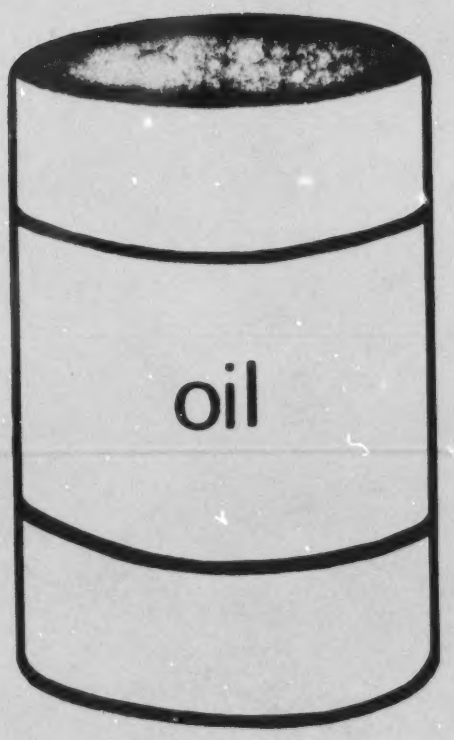
EXAMPLES AND NON-EXAMPLES OF NATURAL RESOURCES

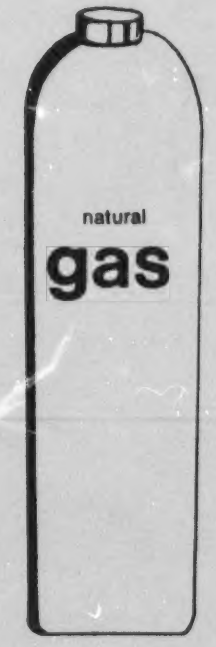


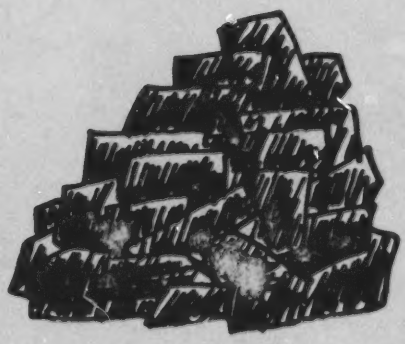


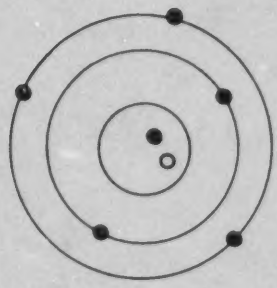
STUDENT
HANDOUT

NATURAL RESOURCES USED TO MAKE ENERGY PRODUCTS









LESSON 1-2: WHAT IS NEEDED TO PRODUCE ENERGY?

CONCEPT: Productive resources: labor, capital, and natural resources

RECOMMENDED USE: Grades K-3

TIME REQUIRED: One class period

MATERIAL REQUIRED: Student worksheet "Energy Pictures"
Transparency "Refinery"
Blackline masters provided
Students will need scissors, glue and crayons.

RATIONALE:

Before goods (e.g. gasoline) and services can be consumed, they must by produced. For this to happen productive resources (also called factors of production) are needed. Productive resources are the inputs to production. Goods and services are the outputs.

The purpose of this lesson is to introduce students, in an informal way, to the factors of production. The production of gasoline is used as an example.

There are three kinds of productive resources. Natural resources (called "things from nature" in this lesson) are elements of the natural environment that are used to produce goods and services. Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on.

Human Resources (called "work" in this lesson) are people and their physical and mental capacities. The number of people available for work, the hours they work, the quality of their skills and their motivation are all dimensions of labor input.

Capital goods (called "things made by people" in this lesson) are those things created by past human effort that are available to produce goods and services in the future. They include machines, tools and factories.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. trace the sequence of events involved in the production of a particular energy product.
2. give examples of the three factors of production.

SUGGESTED TEACHING PROCEDURE

BACKGROUND INFORMATION FOR TEACHER

Oil is a liquid fossil fuel, formed from once-living things and found underground. It is pumped out of the ground through oil wells. When the oil comes out of the ground, it is called crude oil. To make it useful to us, this crude oil is refined. To refine crude oil, it is placed in a furnace and boiled at a temperature range, at atmospheric pressure, from 500-1200° F.

Many products are produced from crude oil, such as: lubricating oil, gasoline, kerosene, home heating oil, and natural gases. This lesson focuses on gasoline.

A. Begin this lesson by asking "What do people use gasoline for?" Students should respond - to run cars, trucks, lawn mowers, etc. (accept all reasonable answers)

B. Then say "Before people can use gasoline, it must be made or produced. Today we're going to look at how gasoline is made."

C. Then distribute the "Energy Pictures" worksheet. Tell students that these pictures are about making and using gasoline. Have them cut out the individual pictures. Then have students (working individually or in small groups) try to arrange the pictures to reflect the sequence of events involved in gasoline production and use.

D. Allow enough time to complete the activity, then discuss the correct sequence as a class. Ask students "Which picture comes first?" Most will respond "the picture of the oil well." "Where is oil found?" Most should answer "in the ground."

You can point out the oil is found in the ground and many oil wells are built right on the ground. But these days oil is often found in ground that is under water. Also mention that the oil coming out of the ground is called crude oil. Ask them "What kinds of work do you think need to be done to get oil out of the ground?" Accept any reasonable answer like "find the oil," "build the oil well," "pump the oil," etc.

E. Then say "We cannot use the oil the way it comes out of the ground. Certain things have to be done to it first. So which picture comes next?" Most will have chosen the refinery although they might not be familiar with the word. Project the transparency of the simplified refinery. Point out that to refine crude oil, it is placed in a furnace and boiled. This makes it much more useful. Refining produces many products -- one is gasoline.

Then ask "What kinds of work do you think need to be done to refine oil?" Again accept any reasonable answer like -- place the crude oil in the furnace, pump it into trucks, keep the factory clean, etc.

F. "In what order should the next two pictures be placed? Responses should be "the truck carrying gas," and then "the gas station."

Then ask "What kinds of work do you think need to be done to get the gasoline to the people who will use it?" Again accept any reasonable answer like "drive a truck", "pump gas", etc.

G. Say "You've seen some pictures. I've told you some things, and you've answered some questions." Then ask "What then is needed to make gasoline?" Have students answer as a group. Write answers on the chalkboard. Group responses in three categories - (attach labels to the categories in Step H below). Students might respond:

Oil	oil wells	oil drilling
	refineries	pumping oil
	trucks	driving trucks
	gas stations	heating oil

H. When the students run out of suggestions, point out that they have mentioned that three different kinds of things are involved in producing gasoline. Now label the categories - "things from nature" - oil, "things made by people" - oil wells, etc. and "work" -oil drilling, etc. Then say that these three kinds of things are involved in producing energy products and all other products, too.

I. To end the lesson, have students glue their pictures, in the correct sequence, to a piece of paper. Be sure that they add the picture of a person using the gasoline in a car. Give them some time to color the pictures.

SUGGESTED EVALUATION STRATEGY:

1. Provide students with simple pictures of the steps involved in the production of electricity from coal. Have them arrange the pictures to reflect the sequence of events involved in the production of electricity.

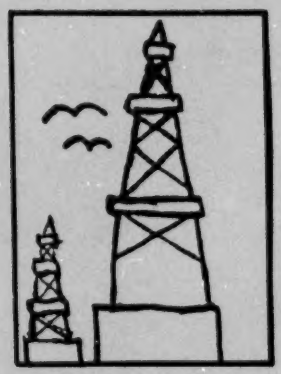
2. Have them identify at least one picture from the sequence that reflects each of the factors of production.

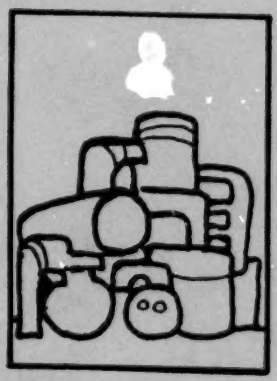
SPIN OFF

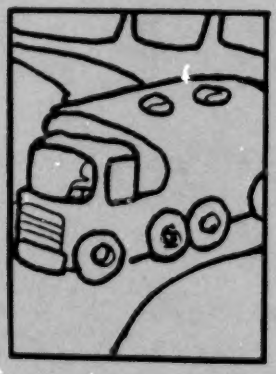
Invite a representative from your local electric utility to class. Have that person describe what electricity is used for in your community and how it is produced. Encourage the presenter to use concrete examples to illustrate his or her presentation. In a debriefing session following the presentation, use a procedure similar to that described in Steps G and H above to help students review what is involved in producing electricity.

STUDENT WORKSHEET

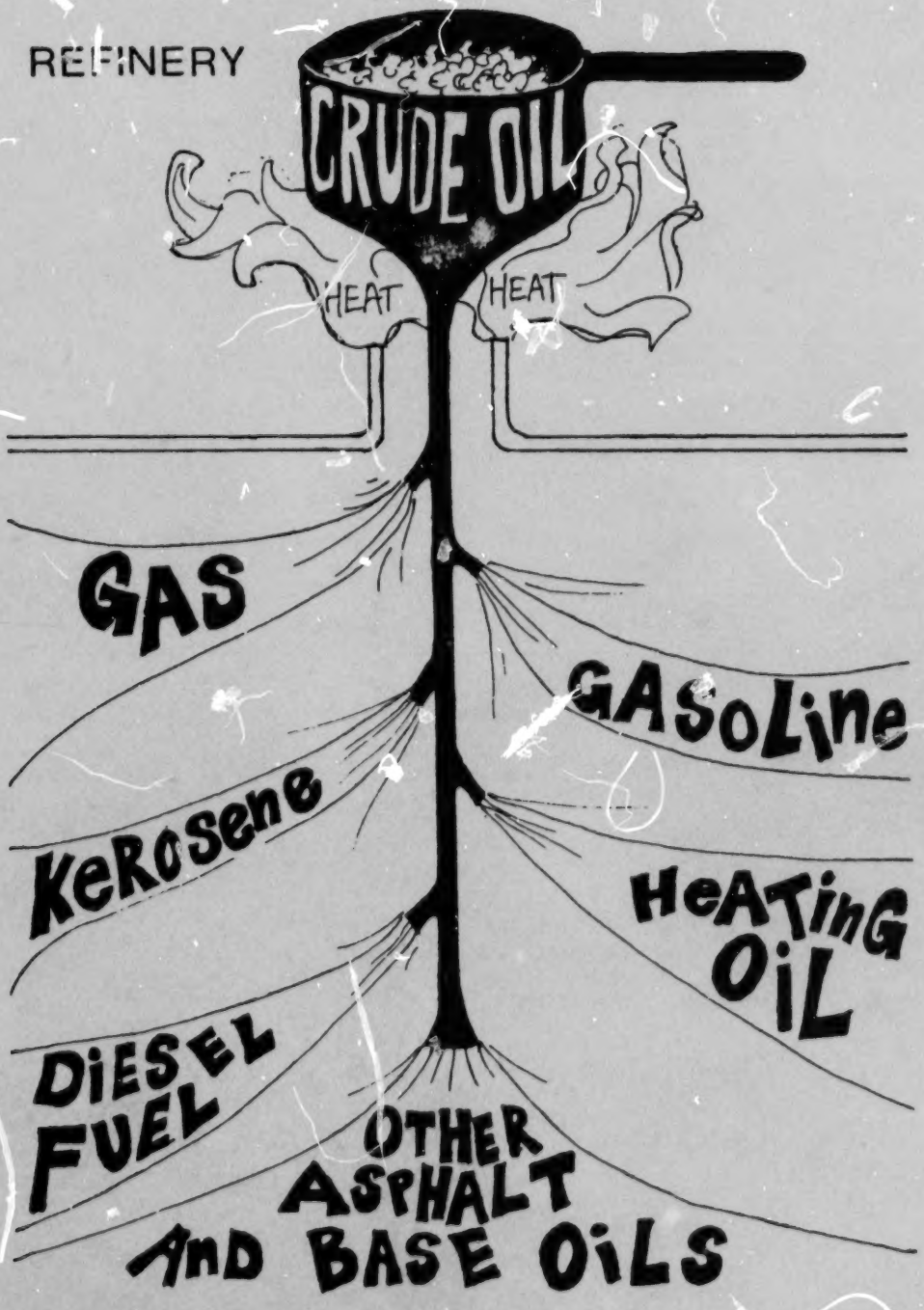
ENERGY PICTURES







TRANSPARENCY MASTER



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LESSON 1-3: USING ENERGY

CONCEPT: Consumption

RECOMMENDED USE: Grades K-3

TIME REQUIRED: 1 or 2 class periods

MATERIALS REQUIRED: Pictures showing the four main places where energy is used. Blackline masters included. You may want to have old magazines available (see Step C.)

RATIONALE:

As background for understanding the current energy situation, it is important for students to understand that energy is a product that people consume to meet certain needs. Some aspects of energy consumption in this country are considered in this lesson.

Satisfying people's wants for goods (products) and services is the main purpose of economic activity. The process of satisfying wants is called consumption. People consume (use) goods and services to satisfy their economic wants.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify major energy uses in the U.S.

SUGGESTED TEACHING PROCEDURE:

A. Begin by saying something like: Everyone of us--old or young, boy or girl, man or woman--uses energy. And we use a lot of it. Today, let's think about how we use energy. Name as many different uses for energy as you can.

NOTE: You might want to have students observe the following rules as they identify energy uses.

Rules for Brainstorming

1. In brainstorming, every idea, however crazy it may sound, is welcome.
2. No one should criticize anyone's ideas! In other words, no comments, no laughter, no funny looks.
3. The goal of brainstorming is for the group to produce as many ideas as possible. Original, zany ideas are welcome.
4. "Hitchhiking" is desirable. That is, if a good idea comes by, pick it up and add to it.

B. Keep a list of student responses. (Set a time limit for responses, probably not more than 20 minutes.)

C. When no more responses are forthcoming, review the list of energy uses with students. Distribute old magazines. Ask students to cut out pictures of different ways energy is used. Mention that these pictures will go on the bulletin board.

D. Place the pictures included with this lesson at the top of a blank bulletin board. Explain to students that these pictures show the four main places where energy is used, in "Homes," "Stores," "Factories," "Transportation."

E. Have each student attach the pictures that he/she cut out to the bulletin board, under the appropriate heading. For example: If the child has cut out a picture of an airplane flying, he would attach it under "transportation." A picture of a women running an industrial lathe would be attached under "factories."

F. End this lesson by saying "Most of the energy that Americans use is used in factories to make things that we need. Moving people and things around (transportation) uses the second most. Keeping our homes warm and well lighted uses the next most energy. Stores use the least."

NOTE: Energy is consumed in the following proportions in this country:

industrial	41.2%
transportation	25.2%
residential	19.2%
commercial	14.4%

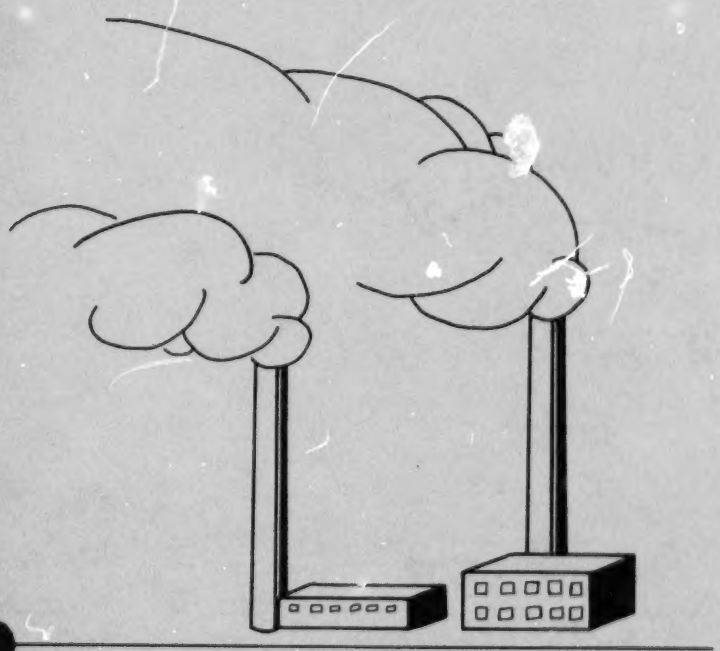
SUGGESTED EVALUATION STRATEGY:

Have students identify several uses for energy. Have them identify which are transportation, residential, commercial and industrial uses.

SPIN OFF:

Invite representatives from one or more major energy users to class. In each case, have them detail how energy is used in their sector (e.g., "home use" - space heating, air conditioning, water heating, refrigeration, etc.). Then have each representative discuss what measures are being taken to reduce waste in his or her particular sector.

PICTURE SET



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LESSON 1-4: THE BEST PRESENT OF ALL

CONCEPT: Decision making, costs/benefits

RECOMMENDED USE: Grades K-3

TIME REQUIRED: 2 class periods

MATERIALS REQUIRED: Light cardboard paper
Crayons or magic markers
Wooden sticks

RATIONALE:

It is important for students to realize that whenever a decision is made, there are costs and benefits associated with it. The purpose of this lesson is to give students an opportunity to begin to identify the benefits and costs, the "good news" and "bad news" respectively, associated with the use of different energy sources. Identifying costs and benefits associated with alternatives is an important step in learning how to make well-reasoned decisions.

INSTRUCTIONAL OBJECTIVE:

On completion of this lesson, learners will be able to:

1. identify some of the costs and benefits associated with certain energy sources.

SUGGESTED TEACHING PROCEDURE:

A. Tell the students that the class will be doing a play that describes different energy sources.

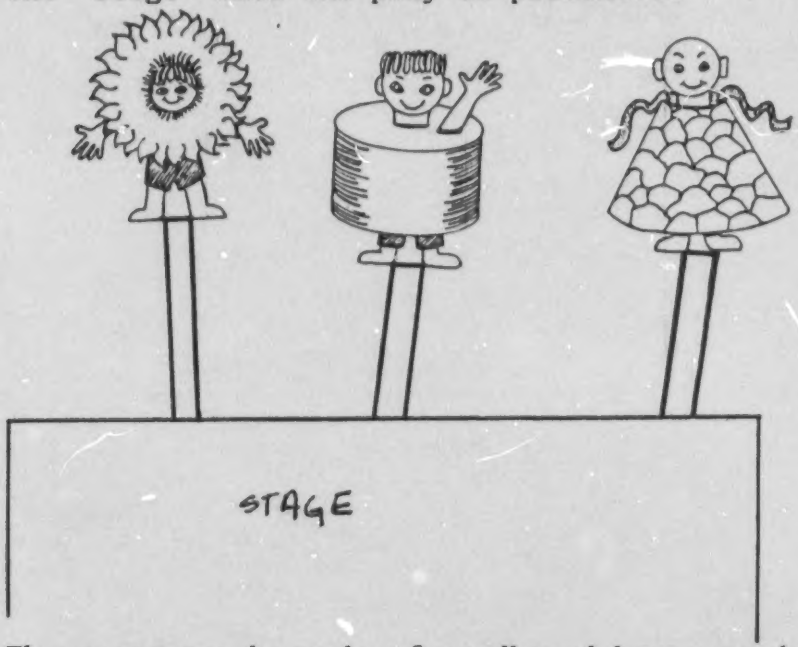
B. Begin by reading the play through to the class, as a story to be enjoyed. (Play is attached.)

C. Discuss the characters in the play. Have students draw and color pictures of the various characters on cardboard. You will need at least the following characters (listed according to order of their appearance,):

King Oliver	Mr. Atom
Wise Persons	General Water
Page Boy	Ms. Geothermal
Ms. Oil	The Golden Sun
Mr. Natural Gas	
Ms. Coal	

You can extend the list by including people of the court.

D. The characters should be cut out and attached to wooden sticks or rigid cardboard, so that they will show above the "stage" when the play is presented.



The stage can be made of cardboard boxes or desks.

E. You might want to invite another class in to see the play performed. Tell your students to raise their characters above the stage as they are mentioned in the play that you will read. Have them lower their pictures when the next character is introduced.

F. At some time after the play, review what they have learned from the story. Ask the children what materials can be used to produce heat and light energy. Discuss the pros and cons of each form of energy, the advantages and disadvantages. This should be kept simple but they may pick up more than you expect. These may be among the things mentioned:

Forms of energy	Good about it	Not good about it
Oil	Easy to transport	Expensive Scarce May leak and spill Gasoline causes air pollution
Natural Gas	Clean	Expensive Limited supply
Coal	More available	Pollutes the air May spoil the environment (strip mining)
Atoms	Available Clean	Poisonous waste
Water	Clean	Some land has to be flooded Not enough available
Geothermal	Clean No poisonous waste	May spoil rivers and streams Available only in limited places
Sun Wind	Unlimited amount available Doesn't spoil the environment	Presently expensive

NOTE: This is in no way meant to be a complete list, nor would you expect your class to pick up all of these. Any answers can be used as an indication of what they've learned from this lesson.

THE PLAY

THE BEST PRESENT OF ALL

Adapted from Ranger Rick's Nature Magazine and condensed by M. Wendy Crater and Harold L. Crater, NSTA.

This is a story about King Oliver who lived in a cold, dark castle. Because he loved the children in his land he invited them to come to a wonderful party. King Oliver wanted his party for the children to be extra-special-special. He wanted to give the children "the best present of all" -- a present for all their lives and all their children's lives, too -- a present for forever.

King Oliver asked his wise persons to help him. They sat in the cold dark castle and shivered as they tried to think of a special present. A page boy with them wished out loud to be warm. His wish gave the King the idea that he could give his children warmth and light forever.

One of the wise persons told the King that a fire would boil water and make steam to warm the castle and turn a motor to make the lights work. The problem would be to find enough fuel. The wise persons made a list of things that can be used to produce energy.

The King invited all of the energy sources to the castle.

Ms. Oil and Mr. Natural Gas came in together to talk with the King. Ms. Oil was large and messy and left oily footprints when she walked. Mr. Natural Gas was small and timid. He was very neat and clean looking.

The King asked them how they could make energy for his children's homes.

Ms. Oil told the King that she was really very clean. It was because there were so many cars that there was air pollution. Mr. Natural Gas also said that he would burn clean. Both admitted that they would not last very long because when they are burned, they are all gone. The King sent them away because his present had to last forever; and they would not.

Ms. Coal came in next. She was a giant, covered with black stones and leaving dirty puffs of coal when she walked.

She told the King that she could not burn clean. Little pieces would get into the air and in people's clothes and lungs, although there was plenty to last a long time. All that had to be done was to push away the grass and trees and dig the coal up.

The King sent Ms. Coal away too. He did not want his children to have dirty air or lose their trees and grass.

The King saw Mr. Atom next. He was a very shiny, neat man who bounced when he walked.

Mr. Atom explained how he could split and make energy. He said he got very, very hot and was full of energy. He did have a problem with a poison called radioactivity but could keep the poison in a box. If the King could find a place to put the box for a very long time, the poison would be all gone.

Sadly, King Oliver sent away Mr. Atom. The King did not want his children to have to worry about poison.

General Water marched into the room and saluted to everyone. He would flood the valleys and rivers and make a dam, he told the King. That dam would give the King some energy for heat and light. He did not want to lose his valleys and mountains, so the King told General Water goodbye.

The King was feeling very sad. He wanted a good source of energy that would not destroy the land or hurt his children.

The wise persons brought Ms. Geothermal to the King. Ms. Geothermal was very round and clean and she puffed and huffed when she walked.

This time the King heard about a good kind of energy that would use the heat already inside the earth to warm homes and turn motors. She could be pumped out of the earth, Ms. Geothermal told everyone in her puffy voice, and the land did not have to be destroyed. King Oliver was happy. He asked Ms. Geothermal to sit beside him. He wanted to talk with her some more.

Suddenly the room was filled with warmth and light. Before them stood the golden sun. She was like a beautiful golden butterfly. Her dress shone like a thousand golden coins and when she smiled all the room was warm.

The golden sun told the King that her energy made plants and people grow. She said her warmth could be caught in a basket of stones and let out at night to warm a house. She could make the wind blow to make electricity. If the King would build his houses to catch the sun, and make windmills, then his children could have warmth and light forever -- because she would be there forever to serve them. Then the golden sun left the King's castle to visit the other side of the earth.

The King spread his arms wide. He smiled a happy smile. He had a wonderfully good present for his children -- warmth and light from the earth and the sun.

"The Best Present of All," adapted with permission from Oliver A. Houck, Tulane University.

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LESSON 1-5: NO WAY OF REDUCING ENERGY USE IS FREE

CONCEPTS: Opportunity cost

RECOMMENDED USE: Grades K-3

TIME REQUIRED: 2-3 class periods

MATERIAL REQUIRED: Pictures: "Candy bar and ice cream cone"
"Decision-making sequence"
"Refrigerator"
Blackline masters provided.

RATIONALE:

Opportunity costs refer to what must be given up when decisions are made to use limited resources in certain ways. For consumers the opportunity cost of something purchased, for example, is the other things that must be foregone.

In deciding whether or not to undertake measures to reduce energy use, it is necessary to consider the costs of a particular measure and its expected benefits. Most people are aware of the benefits associated with energy use reduction measures. But do they realize that there are opportunity costs as well as money costs involved in implementing those measures? The purpose of this lesson is to examine the opportunity costs associated with decisions to reduce energy use.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define opportunity costs;
2. describe opportunity costs involved in decisions related to reducing energy use.

SUGGESTED TEACHING PROCEDURE:

A. Begin by showing pictures of candy bar and ice cream cone (or use the real thing!) and say "Suppose that Daniel wants both a candy bar and an ice cream cone and that the price of each is 35¢. If Daniel has only 35¢ to spend on candy bars and ice cream, does he have to make a choice?" (Student response: Yes.) Why? (Because he does not have enough money to buy both.) If he buys the ice cream cone, what can't he buy? (The candy bar)

B. Continue: "So Daniel has two kinds of costs to think about when he chooses how to spend his 35¢. One is a money cost - 35¢. But he also has another cost that goes along with his choice. This is a cost that is not measured in dollars and cents. Instead it is the opportunity that is passed up when one thing is chosen instead of another. It's called the opportunity cost.

"By deciding to get an ice cream cone, Daniel gave up the opportunity to get a candy bar. So his choice produces two costs - the money cost: 35¢ and the opportunity cost: not being able to get a candy bar. Whenever we make choices, it is important to think about what opportunities are passed up in choosing one thing over another."

C. Use decision-making picture sequence at this point in the lesson. Say "Now let's think about some other situations where choices had to be made. I'll begin: "Last summer a friend of mine picked fresh beans out of her garden. She had to decide whether to eat the beans right away or freeze them for use at a later time. What were her choices?"

(Student response: She could eat the fresh beans right away or she could freeze them for later).

What would the opportunity cost be if she decided to freeze the beans for later use?

(Not having any fresh beans to eat right away)

NOTE: Point out that this is an example of a situation in which the choice involves an opportunity cost but not a money cost.

D. Have students decribe situations in which they had to choose between alternatives. Record these on the chalkboard. Then review each example by first having students identify the alternatives available and then identify the opportunity costs involved when one of the alternatives is chosen over the other. (You might want to have students draw pictures of their decision situations, differentiating alternatives and identifying the alternative chosen and the opportunity cost of that choice.) NOTE: There are many possible responses. Encourage students to think of some situations that did not involve money costs.

E. Complete this portion of the lesson by reviewing the meaning of opportunity costs as follows: (You might want to write these points on the chalkboard or use the decision-making picture sequence to review opportunity costs.)

i) We must sometimes make choices.
ii) When one thing is chosen over another there is sometimes a money cost involved.
iii) There is always an opportunity cost involved.
iv) An opportunity cost is not measured in dollars and cents.
v) It is the next best opportunity that is given up when one thing is chosen instead of another.

F. To begin the second part of the lesson, say "Families are often faced with making choices. Some of these choices have to do with energy. Here's an example:

"Let's suppose that the price of electricity increases. If this happens, most families will try to reduce or cut down on the amount of electricity they use. How can a family cut down on the amount of electricity it uses in its home?" They might respond:

- By turning out lights
- By using electric appliances less
- If they have an electric furnace, they could turn the thermostat down.
- They could insulate the electric water heater.

G. So there are a lot of ways to reduce the amount of electricity used in the home. But before any of these ways are used, some choices must be made, like:

Should we start turning off the lights all the time or should we go on as we are?
Should we buy an "old fashioned" hand operated can opener or keep using our electric one?

H. Let's imagine that your family is faced with making one of these kinds of choices: Your mother examines the family budget very carefully and finds 500 dollars that could be used to buy one of those new, energy-efficient refrigerators that uses only a little electricity to operate. (Show picture.)

She figures that electricity prices will keep going up so by spending some money now for an energy efficient refrigerator, the family will save money in the future on its electricity bills.

Then she starts wondering "Do I go down to the appliance store and buy a new refrigerator or should I spend $500 to get my teeth fixed. These cavities are killing me."

Let's say she decides to go ahead and buy the energy-efficient refrigerator. What are her money costs?

(Student response - $500)

What is her opportunity cost?

(She gives up an opportunity to get her teeth fixed. So the opportunity cost of buying the refrigerator is not getting her teeth fixed.)

I. Present students with the following situations. Each represents a decision that can be made to reduce energy use. Point out that some of the decisions have money costs that go along with them. But students are to only consider opportunity costs. Have them write down (or draw a picture of) an opportunity cost that would result from each of the decisions described. Encourage students to use their imaginations. Be sure, however, that their responses reflect opportunities foreclosed by the decision made in each case.

a. Saving energy by using your air conditioner less
b. Deciding to reduce the amount of gasoline used to run your family car by moving to a home closer to your mother or father's work

Some possible responses:

a. Giving up comfort of cool temperatures in your house
b. Giving up your old friends and familiar neighborhood

J. To end this lesson, remind students that when individuals or families make choices, they must consider the costs that go along with those choices. Point out in closing that when costs are estimated, money costs are sometimes involved. But opportunity costs - opportunities that must be given up when a particular decision is made - must also be considered.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define opportunity costs. Have them give an example from their own experience.

2. Develop a series of short energy-saving decision statements similar to those contained in Step I above. Have students describe an opportunity cost associated with each decision. Here are some possible statements.

a. Deciding to reduce the amount of natural gas used by turning down the thermostat in your home
b. Deciding to reduce the amount of gasoline used by getting your car tuned

SPIN OFF

The U.S. Department of Energy published a free pamphlet entitled "Tips for Energy Savers." Single copies can be obtained by writing:

"TIPS FOR ENERGY SAVERS"
Pueblo, CO 81009

In the pamphlet are hundreds of suggestions for reducing energy consumption. These suggestions are grouped under three headings: (1) In and Around the Home, (2) On the Road, and (3) In the Market Place.

Have students examine the suggestions in the pamphlet. Assign them the task of describing opportunity costs associated with these suggestions.

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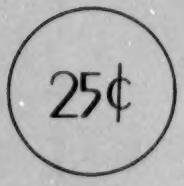

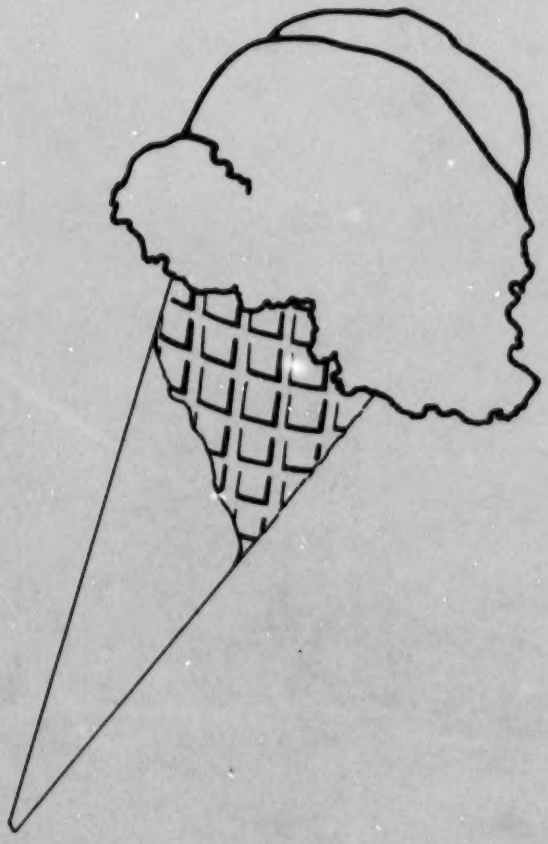

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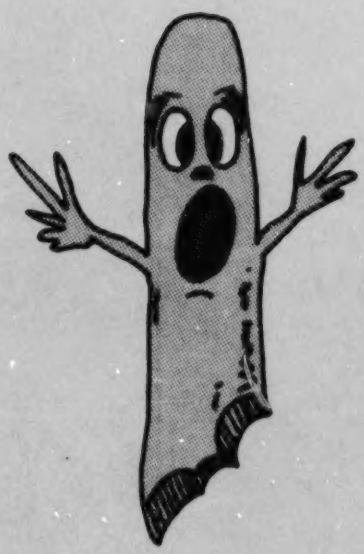

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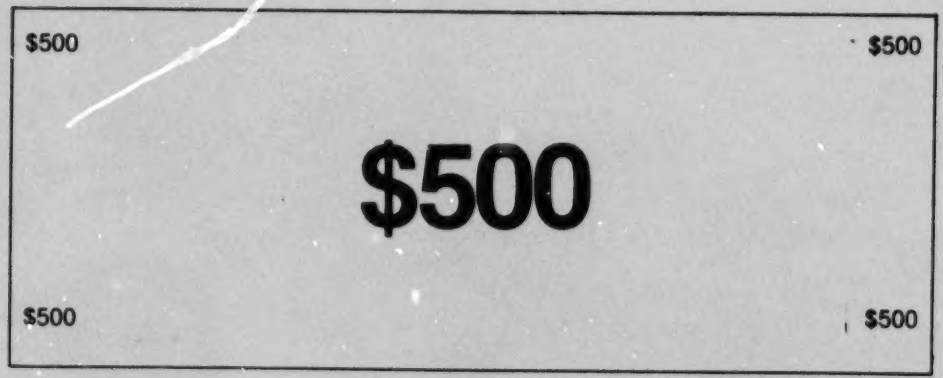

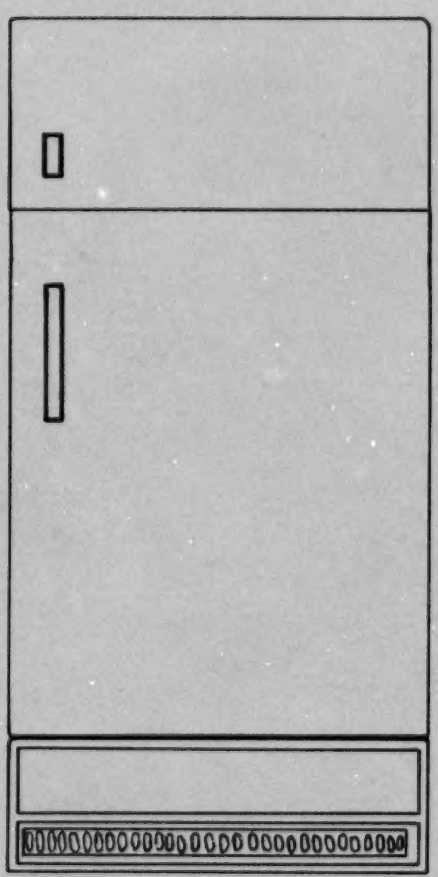

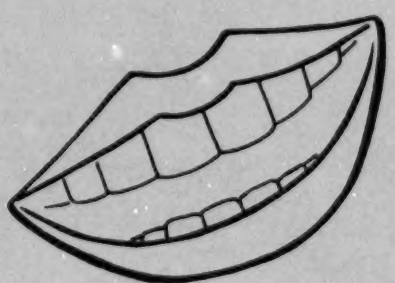

LESSON 1-6: WHAT DO YOU GIVE UP TO PRODUCE ENERGY?

CONCEPT: Opportunity cost

RECOMMENDED USE: Grades K-3

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED: Pictures: "Candy bar and ice cream cone"
"Decision-making sequence"
"Energy Picture Set"
Worksheet: "Other Uses for Resources"
Blackline masters provided

RATIONALE:

Opportunity cost refers to what must be given up when decisions are made to use scarce productive resources to produce particular goods or services. A decision to produce one good means giving up the possibility of producing something else. Thus, the opportunity cost - what could have been produced with the resources instead - is the cost of producing the good. For an individual, the opportunity cost of something purchased is the next best opportunity that must be foregone. For a society, it is the next best alternate use to which productive resources could have been put.

When decisions are made to use scarce resources to produce energy, opportunity costs are involved. Another use of these resources is foreclosed. Citizens must be sure that energy decisions are based on a clear understanding of the opportunity costs involved.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define opportunity costs;
2. identify the opportunity costs involved in decisions involving the use of scarce resources.

SUGGESTED TEACHING PROCEDURE:

NOTE TO TEACHER: If you have already covered the lesson in this series, "No Way of Reducing Energy Use is Free," use steps A-E of the teaching procedure for review purposes. These steps introduce the idea of "opportunity cost." The rest of the lesson applies the idea to producer decisions. In contrast, "No Way of Reducing Energy Use is Free" uses opportunity cost to understand consumer decisions.

A. Begin by showing pictures of candy bar and ice cream cone (or use the real thing!) and say "Suppose that Daniel wants both a candy bar and an ice cream cone and that the price of each is 35¢. If Daniel has only 35¢ to spend on candy bars and ice cream, does he have to make a choice? (Student response: Yes.) Why? (Because he does not have enough money to buy both.) If he buys the ice cream cone, what can't he buy? (The candy bar)

B. Continue: "So Daniel has two kinds of costs to think about when he chooses how to spend his 35¢. One is a money cost - 35¢. But he also has another cost that goes along with his choice. This is a cost that is not measured in dollars and cents. Instead it is the opportunity that is passed up when one thing is chosen instead of another. It's called the opportunity cost.

"By deciding to get an ice cream cone, Daniel gave up the opportunity to get a candy bar. So his choice produces two costs - the money cost: 35¢ and the opportunity cost: not being able to get a candy bar. Whenever we make choices, it is important to think about what opportunities are passed up in choosing one thing over another."

C. Use decision-making picture sequence at this point in the lesson. Say, "Now let's think about some other situations where choice had to be made. I'll begin: "Last summer a friend of mine picked fresh beans out of her garden. She had to decide whether to eat the beans right away or freeze them for use at a later time. What were her choices? (Student response - She could eat the fresh beans right away or she could freeze them for later). What would the opportunity cost be if she decided to freeze the beans for later use? (Not having any fresh beans to eat right away)."

NOTE: Point out that this is an example of a situation in which the choice involves an opportunity cost but not a money cost.

D. Have students describe situations in which they had to choose between alternatives. Record these on the chalkboard. Then review each example by first having students identify the alternatives available and then identify the opportunity costs involved when one of the alternatives is chosen over the other. (You might want to have students draw pictures of their decision situations, differentiating alternatives and identifying the alternative chosen and the opportunity cost of that choice.) NOTE: There are many possible responses. Encourage students to think of some situations that did not involve money costs.

E. Complete this portion of the lesson by reviewing the meaning of opportunity costs as follows:

(You might want to write these points on the chalkboard or use the decision-making picture sequence to review opportunity costs.)

i) We must sometimes make choices.
ii) When one thing is chosen over another, there is sometimes a money cost involved.
iii) There is always an opportunity cost involved.
iv) An opportunity cost is not measured in dollars and cents.
v) It is the next best opportunity that is given up when one thing is chosen instead of another.

F. To begin the second part of the lesson say, something like: "Three different kinds of things are used to make energy products like gasoline or electricity. These three things are "things from nature" like oil; "things made by people" like oil wells; and "work" like people drilling for oil. (NOTE: This is the theme of the lesson in this series "What is Needed to Produce Energy.")

"Whenever one of these things--from nature, made by people, or work--is used to make energy products, it cannot be used to make anything else. So, an opportunity cost is involved."

G. Use the "Energy Picture Set" to provide some examples. Say something like:

a) Here is a picture of 10 barrels of oil. It can be used to make gasoline for cars. It can also be used to make plastic for toys. What is the opportunity cost involved in using the oil to make gasoline? (You might want to answer the first question yourself, providing students with a model answer. So you could say "The opportunity cost involved in using the oil to make gasoline is not being able to use it to make plastic for toys.)

b) Here is a picture of a container of natural gas. It can be used to make heat to keep homes warm. It can also be made into fertilizer to grow food. What is the opportunity cost involved in using the natural gas to heat homes? (Answer: Not being able to use it to make fertilizer)

c) Here is a picture of 10 tons of steel. It can be used to build a factory for making electricity out of coal. The steel can also be used to make a roller coaster. What is the opportunity cost

involved in using the steel to make an electric power plant? (Not being able to use the steel to make a roller coaster)

d) Here is a picture of 50 workers. They could be used to find and mine coal. They could also be used to find and pump water. What is the opportunity cost involved in using the workers to find and mine coal? (Not being able to use the workers to find and pump water)

H. End the lesson by pointing out that whenever choices are made, there are costs that go along with these choices. Point out that when costs are estimated, money costs are sometimes involved. But opportunity costs--opportunities that must be given up when a particular decision is made--must also be considered.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define opportunity costs. Have them give an example from their own experience.

2. Develop a series of picture sequences similar to those used with paragraph G above. Use questions like those in paragraph G to test students' ability to identify the opportunity costs involved in decisions involving the use of scarce resources to produce energy.

SPIN OFF

The work sheet entitled "Other Uses for Resources" will give students additional practice in identifying opportunity costs involved in energy production. The worksheet shows pictures of resources. Beside each is a picture example of how it can be used to produce energy. Ask students to draw pictures showing the next best use for that resource. Let students use their imagination. Accept all reasonable answers.

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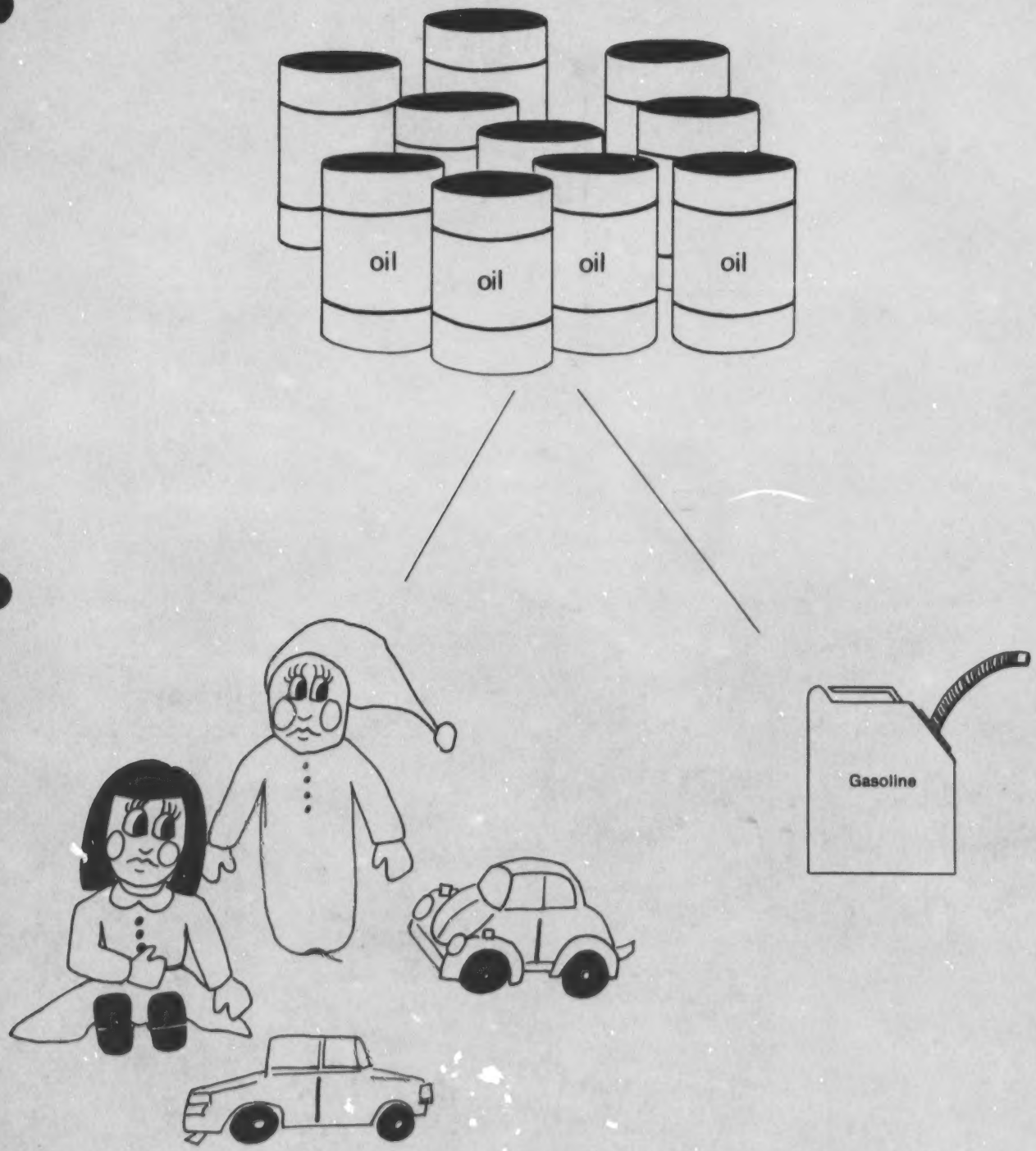

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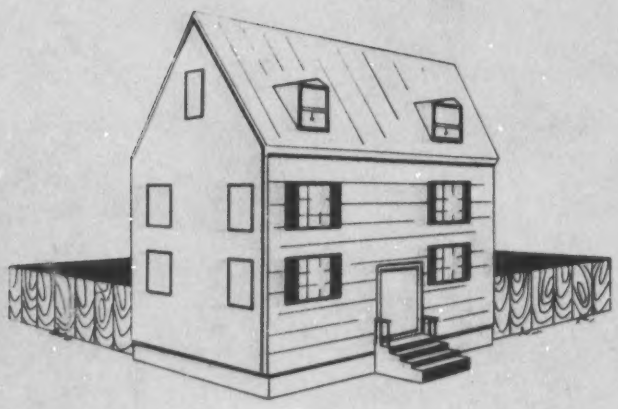

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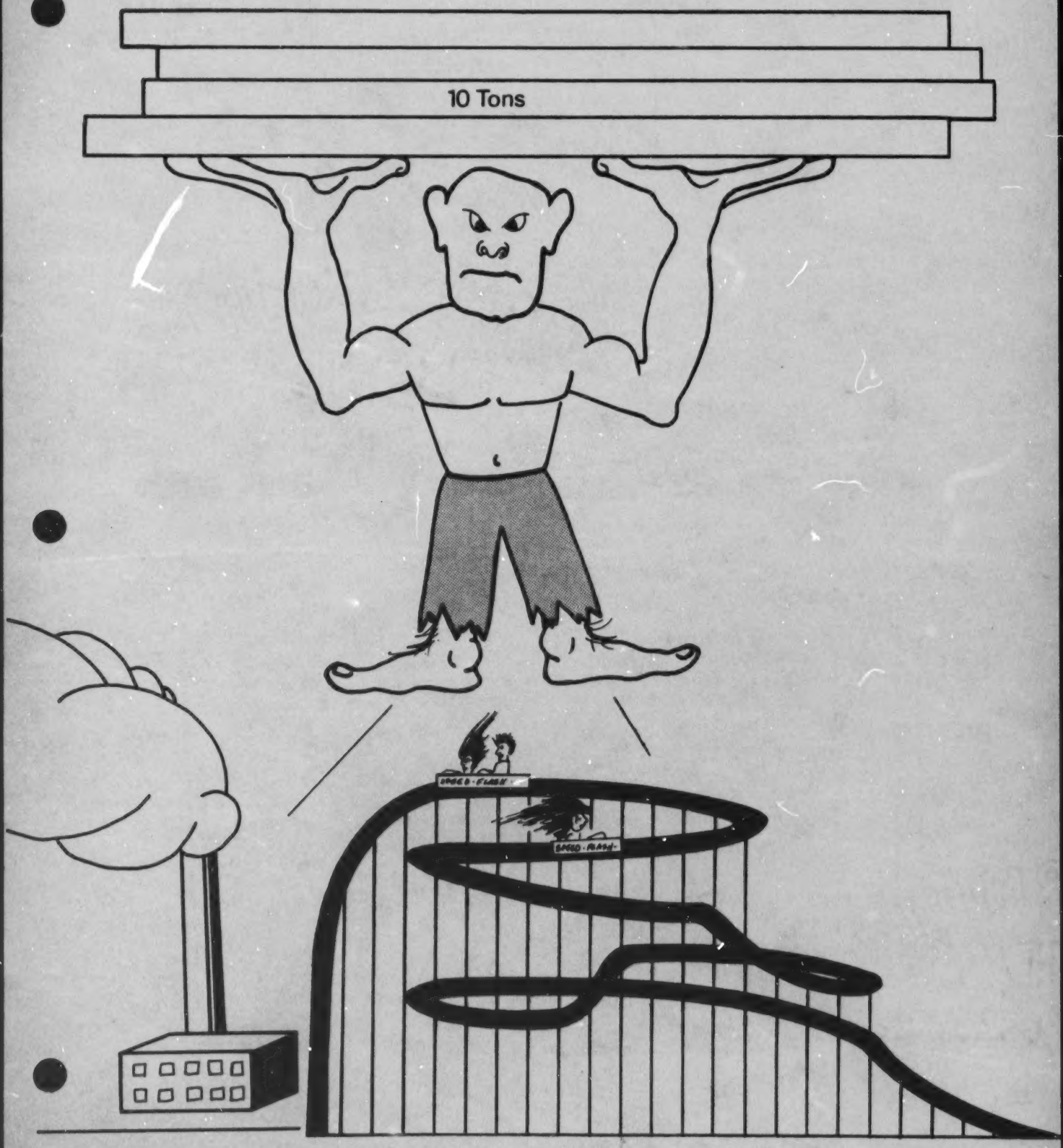

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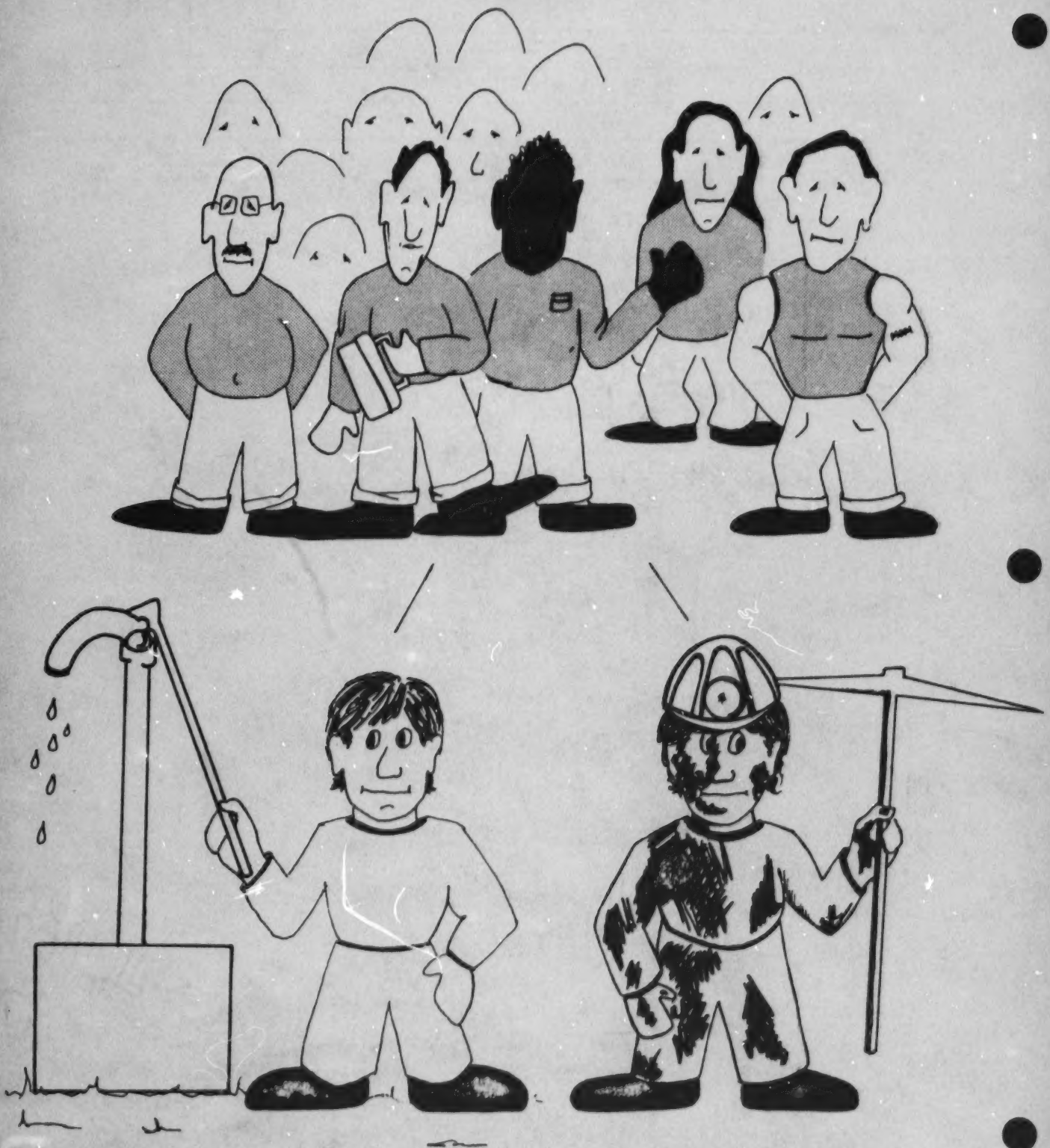
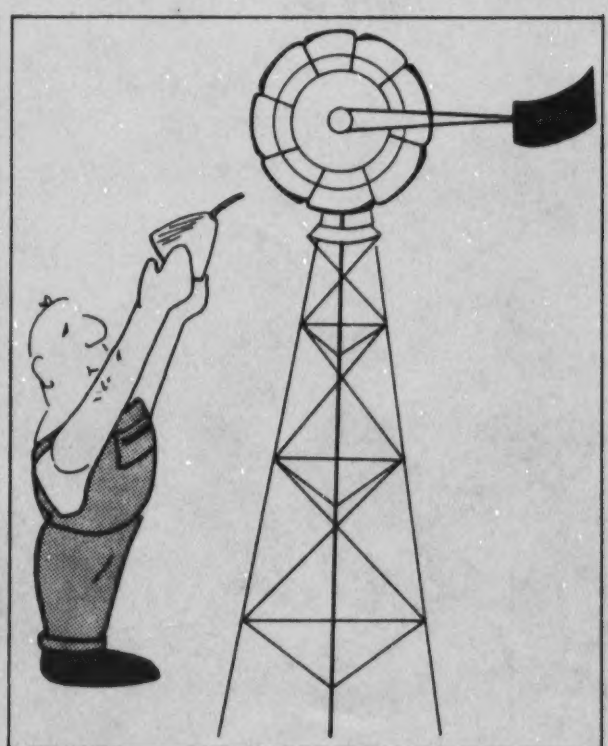


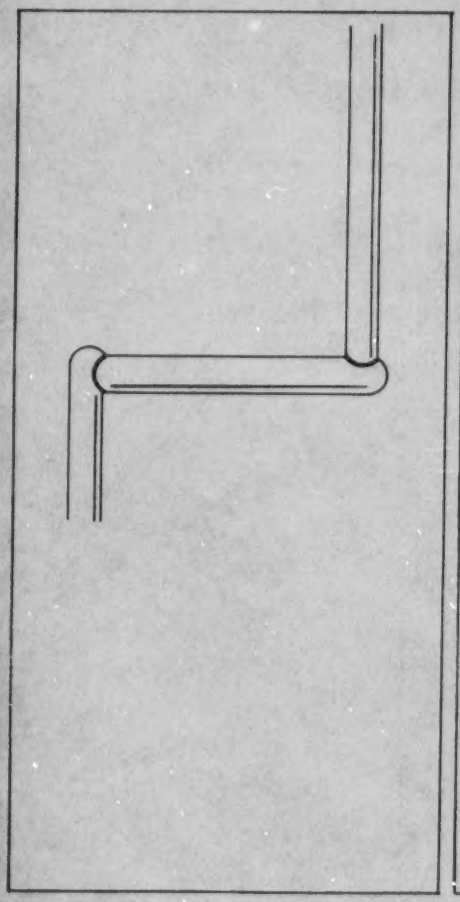
OTHER USES FOR RESOURCES

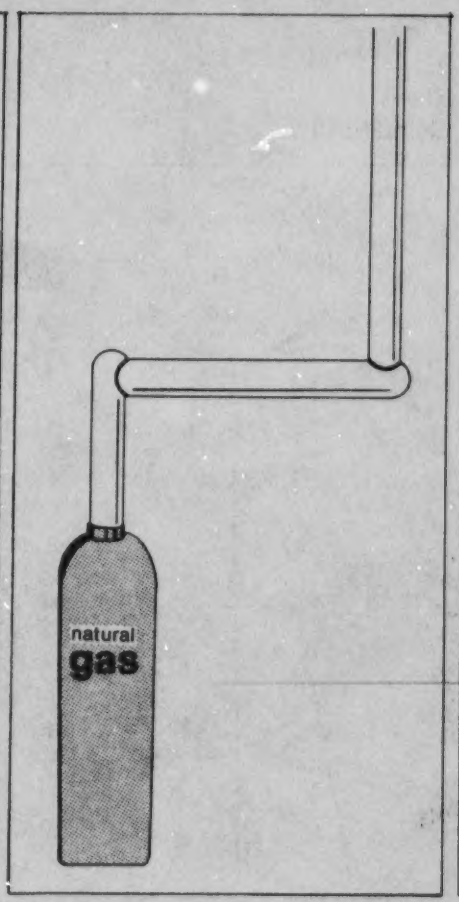
Here are some resources. Name some uses for each resource, other than to produce energy.

Resource:	Energy Use:	Another Use:
farmer's time	oiling windmill	



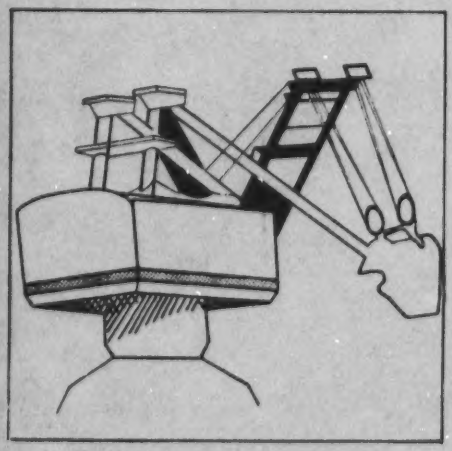
Resource:	Energy Use:	Another Use:
iron pipe	pipeline for natural gas	

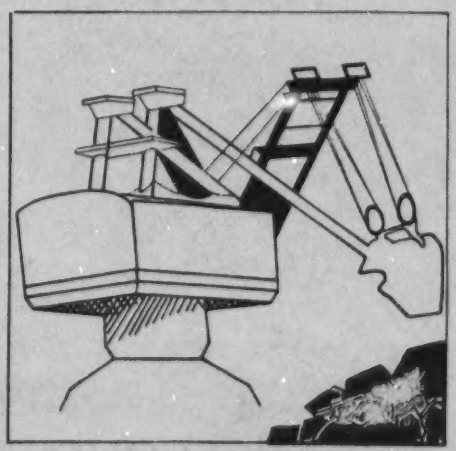




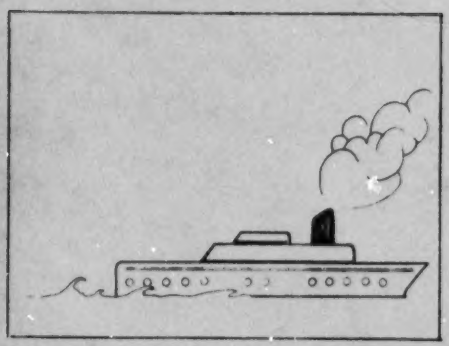
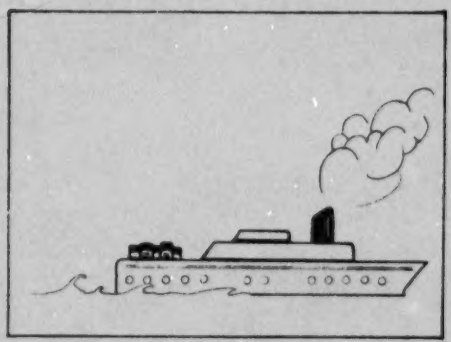
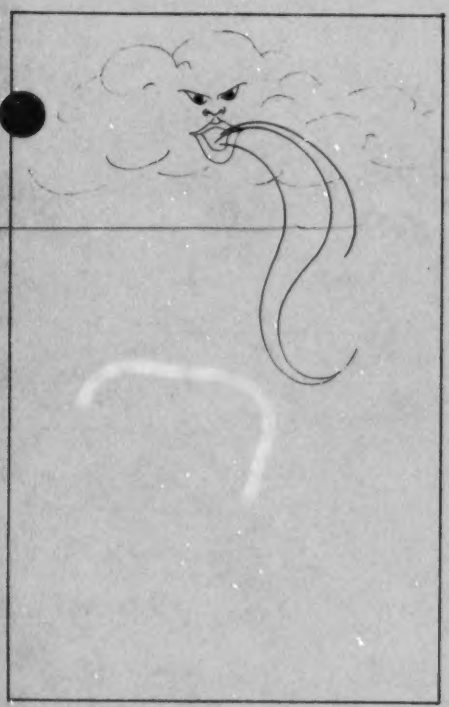
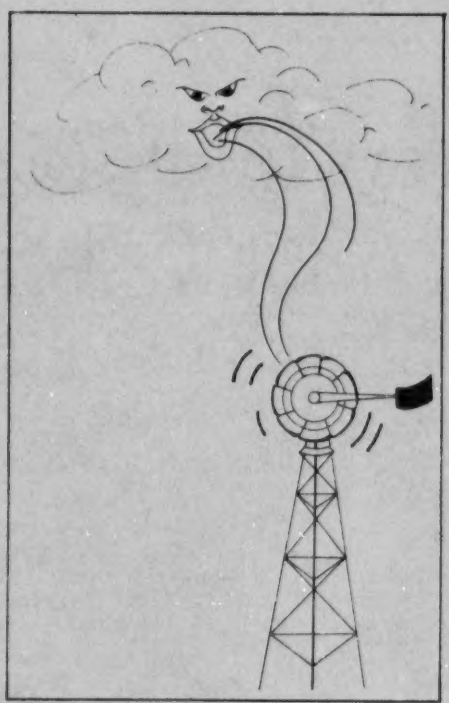
power shovel

surface-mine coal





WORKSHEET

Resource:	Energy Use:	Another Use:
Ship	carry crude oil to U.S.A.	
		
Wind	drive a windmill	
		

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LESSON 2-1: USING ENERGY

CONCEPT: Consumption

RECOMMENDED USE: Grades 4-6

TIME REQUIRED: 1 class period

MATERIALS REQUIRED: Transparency "Breakdown of U.S. Energy Consumption"
Blackline master provided.

RATIONALE:

As background for understanding the current energy situation, it is important for students to understand that energy is a product that people consume to meet certain needs. In this lesson some aspects of energy consumption in this country are considered.

Satisfying people's wants for goods (products) and services is the main purpose of economic activity. The process of satisfying wants is called consumption. People consume (use) goods and services to satisfy their economic wants.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. recall some basic facts about energy consumption in the U.S.
2. identify major energy uses in the U.S.

SUGGESTED TEACHING PROCEDURE:

A. Begin the lesson by putting "2448 gallons of gasoline" on the chalkboard. Have students spend a few minutes guessing what this figure represents.

B. After a few minutes of guessing, tell students that if all the energy consumed or used in the United States in 1982 was changed into gallons of gasoline and divided up among all the people in the country, there would have been 2448 gallons for each man, woman and child. (To make the per capita energy consumption figure more meaningful to students, have them caluculate how long 2448 gallons of gasoline would keep a car running, assuming it used 20 gallons a week.)

C. Say that the class has seen how much energy is used or consumed in the United States in a year. Then say something like "Now let's brainstorm about how energy is used in this country. Name as many different uses for energy as you can."

NOTE: Write the Rules for Brainstorming on the blackboard. Be sure students are aware of rules before brainstorming begins.

Rules for Brainstorming

1. In brainstorming, every idea, however crazy it may sound, is welcome.
2. No one should criticize anyone's ideas! In other words, no comments, no laughter, no funny looks.
3. The goal of brainstorming is for the group to produce as many ideas as possible. Original, zany ideas are welcome.
4. "Hitchhiking" is desirable. That is, if a good idea comes by, pick it up and add to it.

D. List student responses on chalkboard. Do not edit responses. (Set a time limit, probably not more than 20 minutes.)

E. Have the class categorize energy uses by type. (They might categorize uses into transportation, household use, industrial use, etc. Let students decide on their own categories.)

F. To end the lesson, say something like "If all the energy uses you thought of were grouped into four major categories-transportation, residential, industrial and commercial-which category would use the most energy? Which would use the least? Record student responses on the chalkboard. Then project the transparency: "Breakdown of U.S. Energy Consumption." Who was right?

NOTE: While the data on the transparency is from 1968, the percentages in the four categories apply with little change today.

SUGGESTED EVALUATION STRATEGY:

1. Develop a set of true/false statements dealing with energy consumption per capita and uses of energy. Use information in the lesson to generate these statements.

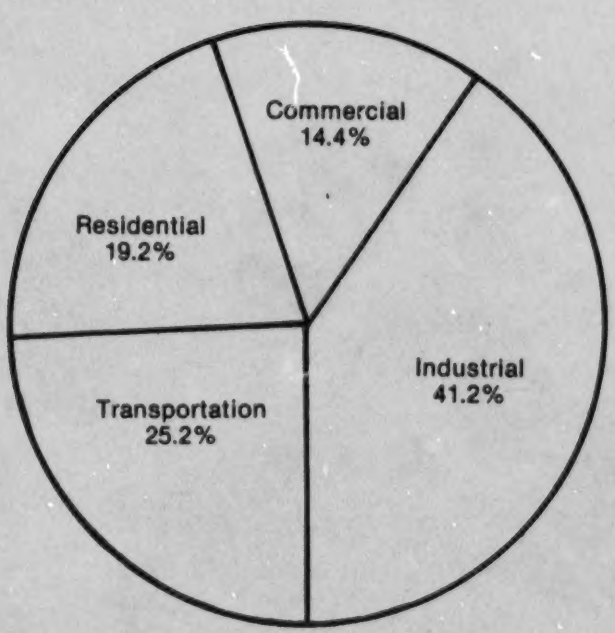
2. Have students list several uses for energy. Have them identify which are transportation, residential, commercial and industrial uses.

SPIN OFF:

Invite representatives from one or more major energy users to class. In each case, have them detail how energy is used in their sector (e.g., "home use" - space heating, air conditioning, water heating, refrigeration, etc.). Then have each representative discuss what measures are being taken to reduce waste in his or her particular sector.

TRANSPARENCY
MASTER

BREAKDOWN OF U.S. ENERGY CONSUMPTION, 1968



Source: Patterns of Energy Consumption in the United States, Office of Science and Technology, Executive Office of the President, Washington, D.C., 1972.

LESSON 2-2: OUR CURRENT ENERGY SOURCES

CONCEPT: Productive resources/natural resources

RECOMMENDED USE: Grades 4-6

TIME REQUIRED: 1-2 class periods

MATERIAL REQUIRED: Student handout "Natural Resources"
Blackline master provided.

RATIONALE:

As background for understanding our current energy situation, it is important for students to know something about our major current energy sources.

Before goods (e.g., gasoline & electricity) and services can be consumed, they must be produced. For this to happen productive resources are necessary. Productive resources constitute the input of production.

Natural resources are one type of productive resource. They are elements of the natural environment that are used to produce goods and services and thereby help people meet their needs.

Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify the characteristics of a natural resource;
2. distinguish between examples and non-examples of natural resources;.
3. list the natural resources that are currently our main energy sources;
4. rank our major energy resources in terms of their contribution to current energy production.

SUGGESTED TEACHING PROCEDURE:

A. Introduce this lesson as follows: "We all use energy products like gasoline, heating oil and electricity. We use these products to warm and light up places. We use them to move us from one place to another. Before we can use these products, however, they must be produced. Producing a product requires three kinds of input:

i) work - human effort
ii) things from nature - things we take from nature, like air, water, sunshine, sand, minerals.
iii) things made by people - things people have made in the past that they can now use to make more things, like factories, saws and can openers.

This lesson will look at one of these inputs - "things from nature," also called "natural resources." (NOTE: The three production inputs are introduced in the lesson entitled "What is Needed to Produce Energy?")

B. Write the following words and definitions on the chalkboard:

Natural resource: something that people take from nature. It is used as an input to make a product people use. They use products made from natural resources to satisfy their needs.

C. Then give some examples:

A tree is a natural resource. People take trees from nature. Ask "What are some of the things that people make from trees?"

Gold is a natural resource. People take it from nature. Ask "What are some of the things that gold is used to make?"

Is a tornado a natural resource? It does come from nature. But it is not used to make anything that people need. So it is not a natural resource.

Is a helicopter a natural resource? It is not taken from nature. It is made from natural resources. It is a product.

D. Have students examine the list of words in Part A of the handout "Natural Resources." Have them distinguish between the natural resources on the list and the other things. Remind them to explain their answers. Review responses as a class. The purpose of this activity is to help students sharpen their understanding of the concept "natural resource." Results should not be used as an evaluation of what is learned. Students should respond as follows:

	Is it a natural resource?		Why?
	YES	NO	
pencil	___	X	It is made from natural resources; it is a product

wind	X	___	It can be taken from nature and used to produce energy to move ships, etc.
apple	X	___	It is taken from nature and can be used to produce apple-sauce, etc.
water	X	___	It can be taken from nature and used to produce many different things
stereo	___	X	It is made from natural resources; it is a product
earthquake	___	X	It comes from nature but is not used to produce anything that people use
rail	___	X	It is made from natural resources; it is a product
natural gas	X	___	It is taken from nature, used to produce heat
copper	X	___	Taken from nature, used to produce a variety of products
hailstones	___	X	Come from nature, but don't produce any product used by people

E. To complete this section of the lesson, have students provide their own examples of natural resources. This can be done orally, in writing, or by drawing or collecting pictures. In each case they should be asked to specify what the natural resource is used to produce.

F. Have students focus on Part B of the Handout "Natural Resources." Point out that Part B contains a pie graph. (You might want to remind students that in a pie graph the pie represents a whole. "Slices" are drawn to show parts of the whole. The size of each slice shows what portion each part contributes to the whole.)

G. Ask students: "What is this pie graph about?" To answer this question have them: i) inspect the graph title, ii) check the graph source, and iii) examine the information on each slice of the pie graph. (Students should respond "This is a pie graph about the natural resources used to produce energy in this country, in 1981. The graph shows what portion of all energy produced was contributed by each natural resource. It is based on information from the Department of Energy.)

H. Have students answer the questions at the end of Part B of the handout. They should respond:

1. 5
2. a - not true; b - true; c - not true
3. petroleum
   natural gas
   coal
   nuclear fuel
   water

I. End this lesson by reminding students that they have learned some things about natural resources, in general, and the natural resources used to produce energy products, in particular. Then ask "What are some questions that you would ask an expert on energy sources if he or she visited your class? (Allow the class to brainstorm as a group. Accept all reasonable suggestions.) Students might respond as follows:

Ask if there are some new or different natural resources that can be used to produce energy products.
Ask what part of the world our energy sources come from.
Ask why petroleum contributes so much energy production.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define a natural resource. Have them give an example and explain why it is a natural resource.

2. Give students a list of words similar to those appearing in Part A of the handout. Have them identify the natural resources on the list.

3. Give students a list of 10 possible energy sources. Have them identify which 5 sources on the list are currently our major energy sources.

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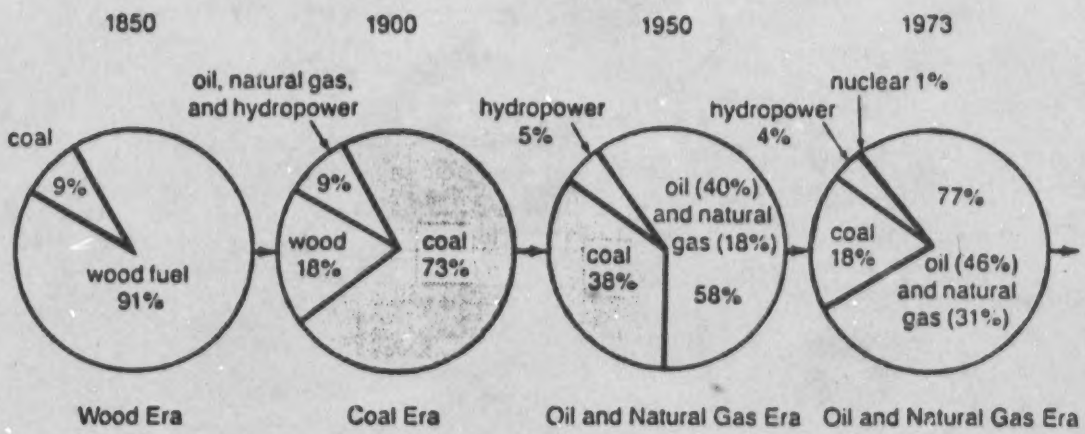
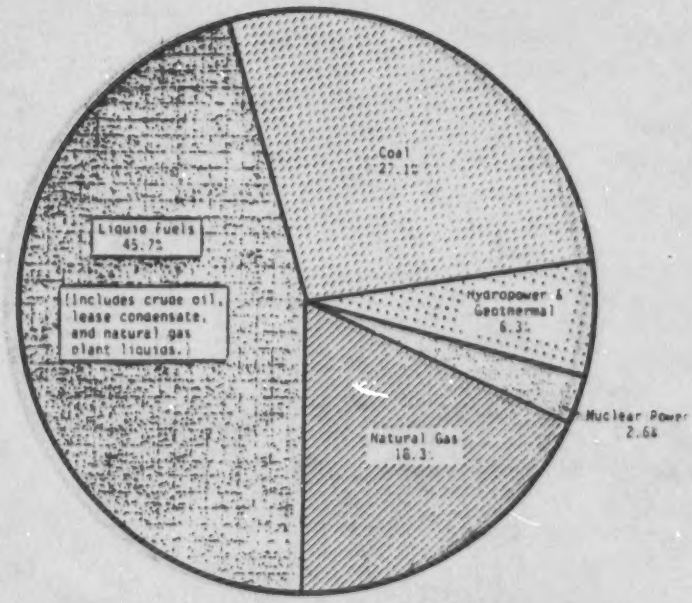
SPIN OFF

Have students examine pie graphs showing energy sources for other historical periods or for the world. Have them identify similarities and differences between these graphs and the one for 1981 used in this lesson. Some useful graphs appear on the following pages.

Changing Patterns in the Use of Energy Resources in the United States



(Data from U.S. Bureau of Census and Resources for the Future) G.T. Miller. Energy and Environment: Four Energy



SOURCES OF WORLD PRIMARY ENERGY IN 1980 (Preliminary)

Includes only crude oil, lease condensate, natural gas plant liquids, dry natural gas, coal, net hydroelectric power, and net nuclear power.

Source: Based on data from: 1980 International Energy Annual. September 1981. pp. 1-12

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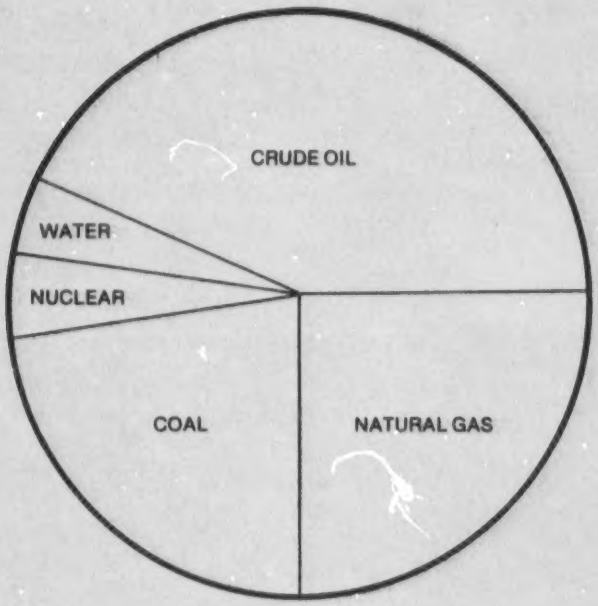
NATURAL RESOURCES

Part A: A natural resource is something that people take from nature. It is used as an input to make a product that people use to satisfy needs. Look at the things in the following list. Which ones are natural resources? Which are not? Explain your answers.

	Is it a natural resource?		
	YES	NO	Why?
pencil			
wind			
apple			
water			
stereo			
earthquake			
rail			
natural gas			
copper			
hailstones			

Part B: "NATURAL RESOURCES USED TO PRODUCE ENERGY PRODUCTS IN THE U.S., 1981"



Your job: Use the information in the pie graph to answer these questions:

1. How many natural resources are used to produce most of the energy products used in this country?

_____

2. Put a check beside each of the following statements which is true:

___ a) More water than coal is used to produce energy products.
___ b) More petroleum than coal is used to produce energy products.
___ c) Natural gas is the major input for energy products in this country.

3. Rank the natural resources by how much each contributes to energy production. Start with the biggest contributor.

_____

_____

_____

_____

LESSON 2-3: WHAT IS NEEDED TO PRODUCE ENERGY?

CONCEPT: Productive resources: labor, capital, and natural resources.

RECOMMENDED USE: Grades 4-6

TIME REQUIRED: One class period

MATERIALS REQUIRED: This lesson begins with the teacher demonstrating the production of an item. In this outline the production of a "bookend" is featured. But you can make almost anything, as long as it involves clear, simple examples of labor, capital goods, and natural resources (see below for definitions of these terms).

If you decide to make a bookend you will need:

-hammer
-nails
-2 pieces of wood about 5" wide and 5" and 8" long. You can nail these together to form a crude bookend.

Student materials included.

RATIONALE:

Before goods (e.g. gasoline) and services can be consumed, they must be produced. For this to happen productive resources (also called factors of production) are needed. Productive resources are the inputs to production. Goods and services are the outputs.

There are three kinds of productive resources. Natural resources (called "things from nature" in this lesson) are elements of the natural environment that are used to produce goods and services. Natural resources include land, water, oil and mineral deposits, the fertility of the soil, climates suitable for growing crops, timber and so on.

Human resources (called "work" in this lesson) are people and their physical and mental capacities. The number of people available for work, the hours they work, the quality of their skills and their motivation are all dimensions of labor input.

Capital goods (called "things made by people" in this lesson) are those things created by past human effort that are available to produce goods and services in the future. They include machines, tools and factories.

As a background for understanding issues related to the production of energy, it is important for students to understand that the production of any good involves inputs of natural resources, capital goods and labor.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify the characteristics of the three factors of production;
2. distinguish among examples of the three factors of production.

SUGGESTED TEACHING PROCEDURE:

A. You might begin the class by saying:

"You know I need a bookend. People always need one thing or another. So what do they do? They go out and buy it. Or they find someone to make it for them. Sometimes they can make it themselves. That's what I'm going to do. I'm going to make a bookend.

"To make my bookend, I'll use this wood. I'll nail these two pieces together with my hammer. Maybe one of you can hold the pieces, while I nail...OK, here is my bookend."

B. Ask students "What was needed to build the bookend that you just saw me make?" Have them answer as a class. Write answers on the chalkboard. They might respond:

"You had to nail the pieces of wood together."
"You needed wood."
"Work had to be done."
"You used a hammer."
"You had to have something to make the bookends out of."
"You needed tools."
"You used nails."

C. When the students run out of suggestions, point out that building this bookend was a simple task. But it was like all production projects. The same three things are needed to produce all goods. Write them on the board along with illustrations:

Work: Human effort
Things from nature: Things we take from nature, like air, water, sunshine, sand.
Things made by people: Things people have made in the past that they can now use to make more things, like factories, saws and can openers.

Note: Emphasize again that anything that is produced requires the input of all three factors.

D. Next use one statement from the student list (generated in response to the question in Step B, above) to further illustrate each of the three factors of production. You might choose:

Work: "You had to nail the pieces of wood together."
Things from nature: "You needed wood."
Things made by people: "You used a hammer."

E. Review the other statements on the list as a class. Have students characterize the statements as examples of "work," "things from nature," or "things made by people." They should respond:

Work: "Work had to be done."
Things from nature: "You had to have something to make the bookend out of."
Things made by people: "You needed tools."
"You used nails."

F. Distribute the worksheet "Producing Energy." Have students read the introduction. Review the introduction with them. Then do the first set of questions, related to Product A, as a class. But, before starting, tell students that moving an energy product from where it is made to where it is to be used is an aspect of production.

They should respond to the questions related to Product A as follows:

1. electricity
2. coal
3. coal cars, generating plant, mining equipment
4. mining coal, operating plant, repairing electric units

Note: Answers given to questions 3 & 4 are typical. There are other answers that are equally correct.

G. Ask students to complete the worksheet during the remainder of the class period. You may want students to work in teams of two. Circulate and check answers. Students might respond as follows:

Product B:
1. gasoline
2. oil
3. oil well, refinery, trucks
4. drilling for oil, driving gasoline trucks, refining oil

Product C:
1. electricity
2. uranium
3. mining equipment, plants, trucks
4. mining uranium
transporting reactor rods
monitoring reactor

SUGGESTED EVALUATION STRATEGY:

1. Ask students to list the three factors of production and give an example of each.

2. Have students complete a worksheet similar to the one that follows:

Shown in column A are some ways people use energy products. In column B are some examples of the "work," "things from nature" and "things made by people" needed to make these products. Write "work" "things from nature" and "things made by people" in column C to describe the examples in column B. The first one is done for you.

To do this...	Requires this...	What is it?
1. Heat a home with a wood stove	Sawing wood into chunks	Work
2. Heat a home with fuel oil	Tanker trucks	Things made by people
3. Move a car using gasoline	Drilling rigs	Things made by people
4. Pump water with windmill	Wind	Things from nature
5. Cook a meal on a gas stove	Watching the pot	Work

SPIN OFF

Invite a representative from your local electric utility to class. Have that person describe how the electricity used in your town is produced. Encourage the presenter to use concrete examples to illustrate his or her presentation. In a debriefing session following the presentation, have students list examples of the three factors of production mentioned in the presentation.

PRODUCING ENERGY

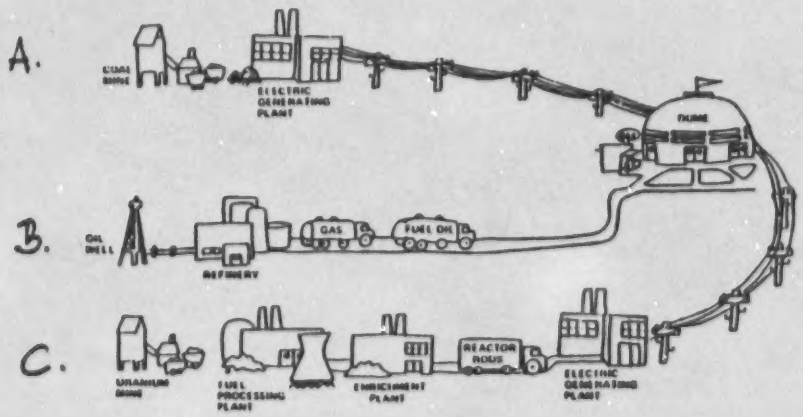
INTRODUCTION

We all use products like gasoline and electricity. We use these products to warm and light up places. We use them to move us from one place to another. Before we can use these products, though, they must be produced. As you know, producing a product requires three things:

i) Work - human effort
ii) Things from nature - things we take from nature; like air, water, sunshine, sand, minerals
iii) Things made by people - things people have made in the past that they can now use to make more things, like factories, saws, and can openers.

YOUR JOB:

Shown below are some energy products being made; they are marked A, B, and C. Look at each one carefully. Then answer the questions about each product in the space provided.



PRODUCT A:

1. What energy product is being produced here?_____
2. What "thing from nature" is being used to make this product?_____

3. What "things made by people" are being used to make this product?_____
4. List three kinds of "work" that you think would be involved in making this product._____

PRODUCT B:

1. What energy product is being produced here?_____
2. What "thing from nature" is being used to make this product?_____
3. What "things made by people" are being used to make this product?_____
4. List three kinds of "work" that you think would be involved in making this product._____

PRODUCT C:

1. What energy product is being produced here?_____
2. What "thing from nature" is being used to make this product?_____
3. What "things made by people" are being used to make this product?_____
4. List three kinds of "work" that you think would be involved in making this product._____

LESSON 2-4: ENERGY ALTERNATIVES

CONCEPT: Decision making, costs/benefits

RECOMMENDED USE: Grades 4-6

TIME REQUIRED: 1-2 class periods

MATERIAL REQUIRED: Student Handouts: "The News Conference"
"News Analysis"
"What Do You Think?"
"Review Sheet"
Blackline masters of handouts are provided.

RATIONALE:

It is important for students to realize that whenever a decision is made there are costs and benefits associated with it. The purpose of this lesson is to give students an opportunity to begin to identify the benefits and costs, the good news and bad news respectively, associated with the use of different energy sources. Identifying costs and benefits associated with alternatives is an important step in learning how to make well-reasoned decisions.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. identify some of the costs and benefits associated with certain energy alternatives;
2. use costs and benefits to make decisions about energy alternatives.

SUGGESTED TEACHING STRATEGY:

A. Begin by explaining that this lesson revolves around a news conference. The news conference is about different sources of energy that can be used to heat and light a new school building.

B. Distribute the "News Conference" handout to the class. Assign students to play the role of I.M. Wright, Doogle of the Bugle, Bailey of the Daily, Parker of the Barker, Hughes of the News, Parr of the Star, and Grimes of the Times. Play the role of announcer yourself.

(You might want to arrange news conference participants as follows: Wright in the front; the newspaper reporters facing him/her; the announcer at a table to the side.)

C. Distribute the "News Analysis" handout to students not assigned to play the roles listed above. Tell them to carefully listen to the news conference, follow it on the "News Conference" handout and be prepared to answer the questions on the "News Analysis" handout, at the end of the news conference. Also say that four of them will act as news analysts after the conference.

Begin the news conference with your speech "We interrupt..."

D. When the news conference is over have the potential news analysts complete the "News Analysis" form. (They can look back at the "News Conference" handout if necessary).

E. Give them sufficient time to complete the form. Then select four students to act as T.V. News Analysts. Assign each the responsibility of reporting on one energy source by repeating the questions on the "News Analysis" form and giving their answers.

F. Then say "We have just heard an important news conference. I.M. Wright has described four possible sources of heat and light for our new school. To help us understand what I.M. Wright actually said, we now present the WNRG-TV News Analyst Team."

G. Ask each analyst to describe what I.M. Wright said about one of the energy sources. (Other students can expand on what the analysts say.) Students might respond as follows (other things can be added):

SOLAR ENERGY?

1. Where does it come from ? The sun.
2. How much will it cost? Expensive in the beginning but is not in the long run. Good as a supplement.
3. What is its effect on the environment? Not a problem (but takes a lot of space).
4. Is there a limited supply? No, there is no end to it.

GEOTHERMAL ENERGY?

1. Where does it come from? Steam and water from underground.
2. How much will it cost? Expensive to find, cheap to use.
3. What is its effect on the environment? Pollutes; also a lot of equipment needed.
4. Is there a limited supply? Yes.

COAL GASIFICATION?

1. Where does it come from? Coal that must be mined.
2. How much will it cost? Not much compared to high priced oil.
3. What is its effect on the environment? Polluting when burned, but not as gas.

4. Is there a limited supply? It is our most abundant fossil fuel. But it is limited.

WINDPOWER?

1. Where does it come from? Wind.
2. How much will it cost? Problem when wind does not blow; good as a supplement.
3. What is the effect on the environment? Non-polluting.
4. Is there a limited supply? No.

H. After the analysts are finished, say "The energy committee has identified four energy sources for the school. You've heard about the advantages and disadvantages associated with each source. Now it's your turn to let the school energy committee know what you think."

I. Distribute the "What Do You Think?" handout. Have students read the instructions. Review them as a class. Then have students fill them out and hand them in. Many responses are possible. But encourage students to frame their answers in terms of the "good news" and "bad news" associated with using a particular energy source or combination of sources.

SUGGESTED EVALUATION:

To conclude this lesson, have students complete the "Review Sheet." Use student answers to these questions to measure what they have learned in this lesson.

SPIN OFF

You might have students examine a number of alternative sources of energy not considered in this lesson in terms of the pro's and con's associated with them.

A reasonable task would be to compare three energy alternatives that can be used to produce electricity. The FREE AND INEXPENSIVE RESOURCES SECTION for this unit lists several sources of information for this task.

THE NEWS CONFERENCE

ANNOUNCER:
We interrupt our program to bring you this WNRG-TV news special. I.M. Wright, chairperson of the committee appointed to study possible energy sources to heat and light the new school building, is holding a press conference to announce the four sources that will be considered and is ready to field questions from the reporters about the choices.

WRIGHT:
Our committee has considered many possibilities, but we've finally narrowed our choices down to four: solar, geothermal, windpower and making oil and gas from coal.

DOOGLE OF THE BUGLE:
What, exactly, is solar energy?

WRIGHT:
Very simply, solar energy is sunlight - sunlight collected using glass or metal plates or special solar "cells."

BAILEY OF THE DAILY:
How soon do we run out of solar energy and have to go through all this again?

WRIGHT:
Never! The sun will shine whether we collect its rays for energy or not. And it won't stop shining if we do use it.

PARKER OF THE BARKER:
That's good news! Now, let's have the bad. How much?

WRIGHT:
Cost? Is that what you mean? Well, it will be expensive in the beginning to install solar equipment because of the new technology involved, but once it's in, heating costs will be cheaper than using conventional systems. Solar systems will need some kind of back-up heating system to help when the sun doesn't shine. However, using sun energy is good for the environment. It provides heat and light for animal and plant life all the time.

HUGHES OF THE NEWS:
Geothermal - what's that? Sounds like a new name for winter woolies!

WRIGHT:
If it were, you really would have a hot seat! Geothermal energy is steam or hot water from under the earth's surface. When this steam or hot water pushes through the earth's surface, it makes a hot spring or a geyser - like "Old Faithful."

PARR OF THE STAR:
So, how do we use it for energy?

WRIGHT:
We can pipe it directly into the school to fill the radiators, or we can pipe it to electric plants where it will turn turbines and generate electric power. Then we send it into the school building by wires.

GRIMES OF THE TIMES:
Four quick questions: How much does it cost? How much do we have? Where is it located? How dangerous to the environment?

WRIGHT:
It's expensive to find the reservoirs, which are located mostly in the Western U.S., but once they're found, steam is low in cost compared to fossil fuels. Problem is, we don't have a lot of this energy source. And it will have some bad side-effects as far as the environment goes. Wells, roads, ponds, large above-ground pipes and power plants are part of the package.

DUNN OF THE SUN:
So why consider it? I heard it can pollute streams and air, too.

WRIGHT:
That's true. Well, we considered it because it can be used directly and doesn't need to be mined, or processed, and it makes basically clean heat.

DOOGLE:
I thought I heard you say coal. Isn't that a step backward?

WRIGHT:
Not really. Coal is our most abundant fossil fuel. 90 percent of our fossil fuel reserve is coal, and we use only a very small amount of it.

BAILEY:
If we start using it, won't coal begin to run out, too?

WRIGHT:
Sure it will. But since there's so much of it there, we can use it to buy time for technology to catch up and find an effective alternative to fossil fuels.

PARKER:
Isn't coal a terrible pollutant?

WRIGHT:
Burning coal is polluting, but we're considering gasified and liquefied coal. Gasification removes the sulfur and other pollutants and can give us a substitute for natural gas. Coal liquefication is the process of converting coal to a liquid. This liquefied coal can be refined like petroleum and can be transported through existing oil pipelines.

HUGHES:
Is this an expensive alternative?

WRIGHT:
It used to look expensive. Now, with the skyrocketing prices of petroleum, it's starting to look like a bargain.

PARR:
What's it going to do to the environment?

WRIGHT:
Well, let's just say that the results aren't going to win a garden club award. Coal first has to be mined; it could destroy thousands of acres of land unless the mines are reclaimed.

GRIMES:
Let's get to windpower. What could we do with the wind?

WRIGHT:
Like solar, probably only hope to use it to supplement another energy source. But, like the sun, the wind is not something that nations can keep to themselves. Every nation has a free supply. It requires no mining, and it is non-polluting as it has no dangerous by-products.

DOOGLE:
(interrupting) Excuse me, but....what do we do if the wind doesn't blow? Get out our oars?

WRIGHT:
That's the obvious problem. The wind would have to blow to create the energy needed to generate electricity.

ANNOUNCER:
Sorry, folks, that's all we have time for. Now stay tuned for WNRG-TV News Analysts.

NEWS ANALYSIS

Think about what you heard in the press conference. Answer the questions in the space provided. You can go back and check your answers with the press conference sheet.

What did I.M. Wright say about....

SOLAR ENERGY?

1. Where does it come from?_____
2. How much will it cost?_____
3. What is its effect on the environment?_____
4. Is there a limited supply?_____

GEOTHERMAL ENERGY?

1. Where does it come from?_____
2. How much will it cost?_____
3. What is its effect on the environment?_____
4. Is there a limited supply?_____

COAL GASIFICATION:

1. Where does it come from?_____
2. How much will it cost?_____
3. What is its effect on the environment?_____
4. Is there a limited supply?_____

WINDPOWER

1. Where does it come from?_____
2. How much will it cost?_____
3. What is its effect on the environment?_____
4. Is there a limited supply?_____

STUDENT HANDOUT

WHAT DO YOU THINK?

Let the school energy committee know what you think.

If you like one of their choices best - check it off. Then explain why you picked it in the space below.

If you think the school should use more than one source - check them off. Then explain why you picked them in the space below.

___ Solar

___

___ Geothermal

___

___ Coal-gasification

___

___ Wind

___

Explain:

STUDENT HANDOUT

REVIEW SHEET

Write answers to the following questions in the space provided.

1. What were two advantages about solar energy that made it seem like a good energy source for the school committee to choose? How about two disadvantages?

2. What were two advantages about geothermal energy that made it seem like a good energy source for the school committee to choose? How about two disadvantages?

3. If you were asked to choose between solar and geothermal energy to heat and light the new school, which would you choose? Why?

LESSON 2-5: NO WAY OF REDUCING ENERGY USE IS FREE

CONCEPT: Opportunity cost

RECOMMEND USE: Grades 4-6

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED: Student materials included.

RATIONALE:

Opportunity costs refer to what must be given up when decisions are made to use limited resources in certain ways. For consumers, the opportunity cost of something purchased, for example, is the other things that must be foregone.

In deciding whether or not to undertake measures to reduce energy use, it is necessary to consider the costs of a particular measure and its expected benefits. Most people are aware of the benefits associated with energy use reduction measures. But do they realize that there are opportunity costs as well as money costs involved in implementing those measures? The purpose of this lesson is to examine the opportunity costs associated with decisions to reduce energy use.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

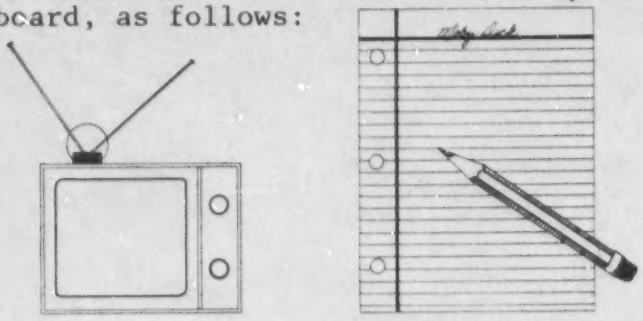
1. define opportunity cost;
2. describe opportunity costs involved in decisions related to reducing energy use.

SUGGESTED TEACHING PROCEDURE:

A. Begin by saying "For most of us, time is a good example of a limited resource. We always have so much we want to do, but a limited amount of time to do it in. We must make choices about the use of our limited time, and other limited resources."

B. Go on, "Imagine that tonight you will have one hour available between supper and bed time. How will you use that time? You could watch T.V. Your favorite show is on tonight. You could spend the time finishing a book report. It's due the day after tomorrow. These are your choices."

C. Diagram the situation described in Step B on the chalkboard, as follows:



One Hour time -- a limited resource

choices - Watch T.V. Finish Book Report

D. Then say, "Decisions have costs that go along with them that are not measured in dollars. These kinds of costs refer to the opportunities that are passed up when one choice is taken instead of another. These costs are called opportunity costs."

E. "Let's say you choose to watch you favorite program. What is the opportunity cost of making that choice? You pass up an opportunity to finish your book report. So the opportunity cost of watching T.V. tonight is not finishing your book report.

F. Ask "What is the opportunity cost involved in choosing to finish your book report?" Students should respond, "Well, I give up the opportunity to watch my favorite T.V. program. So the opportunity cost of finishing my report is not being able to watch T.V."

G. Distribute the student handout "Opportunity Costs." Have students read the directions for Part A. Review the directions as a group. Then have students complete Part A.

H. Review student answers to the questions posed in Part A of the handout. They should respond:

Situation One:
i) Mark's time is the limited resource.
ii) Student's choice
iii) If student picks football, then the opportunity cost is not being able to play soccer. If student picks soccer, then the opportunity cost is not being able to play football.

Situation Two:
i) Tina's allowance is the limited resource.
ii) Student's choice

iii) If student chooses to grow tomatoes, then the opportunity cost is not being able to grow green peppers. If the student picks green peppers, then the opportunity cost is not being able to grow tomatoes.

I. Complete this portion of the lesson by reviewing the meaning of opportunity costs as follows (You may want to write these points on the chalkboard):

i) We must make choices about the use of our limited resources.
ii) When one thing is chosen over another, there is sometimes a money cost involved.
iii) There is <u>always</u> an opportunity cost involved.
w) An opportunity cost is not measured in dollars and cents.
v) It is the opportunity that is given up when one thing is chosen instead of another.

J. To begin the second part of the lesson, say "Consumers are often faced with making choices. Some of these choices have to do with energy. Here's an example:

"Let's suppose that the price of electricity increases. If this happens, most consumers will try to reduce or cut down on the amount of electricity they use." Then ask "How can a consumer cut down on the amount of electricity she uses in her home?" Record student responses on the chalkboard. They might respond:

- By turning out lights
- By using electric appliances less
- If she has an electric furnace, she could turn the thermostat down.
- She could insulate her electric water heater.

K. So there are a lot a ways to reduce the amount of electricity used in the home. But before any of these ways are used, some choices must be made, like:

- Should we start turning off the lights all the time or should we go on as we are?
- Should we buy an "old fashioned" hand operated can opener or keep using our electric one?

Let's imagine that a consumer is faced with making one of these kinds of choices: She examines the family budget very carefully and finds 500 dollars that could be used to buy one of those new energy-efficient refrigerators that uses only a little electricity to operate.

She figures that electricity prices will keep going up, so by spending some money now for an energy efficient refrigerator, the family will save a lot of money in the future on the electric bills.

Then she starts wondering "Do I go down to the appliance store and buy a new refrigerator or should I spend $500 to get my teeth fixed? These cavities are killing me!"

"Let's say she decides to go ahead and buy the energy - efficient refrigerator. What are her money costs?" (Student response - $500) What is her opportunity cost? (She gives up an opportunity to get her teeth fixed - so the opportunity cost of buying the refrigerator is not getting her teeth fixed.)

L. Have students read the directions for Part B of the handout "Opportunity Costs." Review the directions as a group. Then have students complete Part B. Encourage them to use their imaginations.

M. Review student responses to the questions asked in Part B as a class. Many answers are possible. Be sure, however, that they represent opportunities foreclosed by the decision made in each case. Some possibilities:

a. Giving up comfort of cool temperatures in your house.
b. Giving up the opportunity to move around the city on your own schedule: what you could have done with the time spent waiting.
c. Other things you could have done with your time and money.
d. Giving up your old friends and familiar neighborhood.
e. Giving up spare time that you spent to buy and operate a large refrigerator needed to store all that perishable food.

N. To end this lesson remind students that when consumers make decisions, they must consider the costs as well as the benefits that go along with those decisions. Point out in closing that when costs are estimated, money costs are often important. But opportunity costs - opportunities that must be given up when a particular decision is made - must always be considered.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define opportunity costs. Have them give an example from their own experience.

2. Develop a series of short energy-saving decision statements similar to those contained in Part B of the student worksheet. Have students describe an opportunity cost associated with each decision. Here are some possible statements:

   a. Deciding to reduce the amount of natural gas used by turning down the thermostat in your home

   b. Deciding to reduce the amount of electricity used by buying a more energy-efficient refrigerator

   c. Deciding to reduce the amount of gasoline used by getting your car tuned

SPIN OFF

The U.S. Department of Energy published a free pamphlet entitled "Tips for Energy Savers." Single copies can be obtained by writing:

"TIPS FOR ENERGY SAVERS"
Pueblo, CO 81009

In the pamphlet are hundreds of suggestions for reducing energy consumption. These suggestions are grouped under three headings: (1) In and Around the Home, (2) On the Road, (3) In the Market Place.

Have students examine the suggestions in the pamphlet. Assign them the task of describing opportunity costs associated with these suggestions.

OPPORTUNITY COSTS

Part A: Shown below are choices faced by different people. In each case (1) identify the limited resource described, (2) identify the choice that you would pick and (3) state the opportunity cost involved in making that choice. Use the space provided for your answers.

Situation One: Mark can either play on the Boys Club soccer team after school or play Junior League baseball.

i) What limited resource is described here?_____

ii) Which choice would you pick?_____

iii) What is the opportunity cost involved in making that choice?_____

Situation Two: Tina can spend her allowance to buy a new record album or a new shirt.

i) What limited resource is described here?_____

ii) Which choice would you pick?_____

iii) What is the opportunity cost involved in making that choice?_____

Situation Three: Bill grows vegetables in a small garden behind his house. He has enough space left to plant either tomatoes or green peppers.

i) What limited resource is described here?_____

ii) Which choice would you pick?_____

iii) What is the opportunity cost involved in making that choice?_____

Part B: Listed below are 5 decisions that you could make to reduce energy use. There are benefits (in terms of possible future savings) that go along with each. Some decisions have money costs that go along with them. Your job, however, is to consider only opportunity costs. Write down, in the space provided, an opportunity cost that would go along with each of these decisions. Many different answers are possible.

a. Saving energy by turning up the thermostat on your air conditioner _____

b. Deciding to reduce the amount of gasoline used by taking the bus _____

c. Deciding to reduce the amount of heating oil used by spending the weekend caulking and weather stripping your home _____

d. Deciding to reduce the amount of gasoline used by moving to a home nearer the place where you work _____

e. Saving gasoline by doing all your grocery shopping in one weekly trip _____

LESSON 2-6: HOW MANY SHOULD WE BUY?

CONCEPT: Demand

RECOMMENDED USE: Grades 4-6

TIME REQUIRED: 1-2 class periods

MATERIALS REQUIRED:
- One apple
- Student handout "My Demand Schedule"
- Transparency "Class Demand"
- Student handout "Demand for Gasoline in Hoosierland"
- Student handout "Scenes at a Hoosierland Service Station"
- Blackline masters provided

RATIONALE:

The concepts of supply and demand are extremely helpful in understanding energy issues. Unfortunately the concepts are often used in a confusing manner by writers and speakers. It is therefore important that students learn the correct definitions of these concepts and their accurate application to energy use. The purpose of this lesson is to clarify the concept demand.

The demand for a good refers to the amount of that good that consumers are willing and able to purchase at various possible prices, other things being equal, during some particular period of time. The lower the price, the more will be demanded and vice-versa.

INSTRUCTIONAL OBJECTIVES:

On completion of this lesson, learners will be able to:

1. define demand;
2. describe the relation between prices and the quantity demanded.

SUGGESTED TEACHING PROCEDURE:

A. Begin this lesson by showing the apple to the students. Describe it (weight, variety) and let students examine it. Then say, "Raise your hand if you would buy apples like this one."

B. Distribute handout "My Demand Schedule." Explain that in the column labeled "Amount I Would Buy" students should write the number of apples they would be both willing and able to buy at each price, today. (Note: you might need to explain that "willing" means you would like to buy something; "able" means you have the money to buy something.)

C. Point out that someone who is willing and able to buy two apples at 30 cents each would be willing and able to buy at least two apples (and maybe more) at 25 cents each. Then, for each price in turn, ask: "How many apples would you be willing and able to buy if apples were _____ cents each? Have students write the amount they would buy on their schedules.

D. After students complete the handout, project transparency "Class Demand Schedule." Have students raise their hands with fingers extended to show the number of apples they would be willing and able to buy at each price as you announce it. Write the total amount demanded on the appropriate line of the class schedule. (There may be prices at which no apples are demanded).

E. Point out that the schedule just created shows the demand for apples, today. Demand refers to the amount of something, in this case apples, that people (your students) are willing and able to buy at various prices, other things being equal. Ask "How many apples would this class be willing and able to buy if they sold at 50 cents each? How about 1 cent each?"

F. Project transparency "Class Demand Graph." Select students to plot the data on class demand as points on the chart. Then connect points.

G. Ask the following questions about the line graph created in Step F. (Note: This might be a good opportunity for you to introduce some of the features of line graphs.)

a. How many apples was the class willing and able to buy at 25 cents per apple?

b. At what price was the class willing and able to buy _____ apples?

c. As the price of each apple went up, what happened to the number of apples the class was willing and able to buy? (Student response - it went down)

d. As the price of each apple went down, what happend to the number of apples the class was willing and able to buy? (Student response - it went up)

e. What general statement can you make about how the price of apples affected the number of apples the class was willing and able to buy? (Students might respond: As price went up, the number of apples the class was willing and able to buy went down and vice-versa.)

H. You might want to have students create a second demand schedule and graph (using the procedures described above) for an item that most students value more than apples--like candy bars or "Twinkies." This will give students an idea of how the amount of a good demanded at various prices depends on the nature of that good.

I. Distribute handout "Demand for Gasoline in Hoosierland." Point out that the information on the handout is fictional but it is realistic.

J. Have students follow the directions in Part A of the handout. They should respond. Demand refers to the (amount) of a product, in this case (gasoline), that people are willing and (able) to buy at various (prices). The table says that if gasoline was offered for sale at $2.00 a gallon, the amount demanded would be (20,000) gallons. If the price was ($1.00), the amount demanded would be 40,000 gallons.

K. Have students answer the questions in Part B of the handout. They should respond:
   a) 50,000 gallons
   b) $1.20 a gallon
   c) It went down.
   d) It went up.
   e) Possible response: As price goes up, the number of gallons of gasoline demanded goes down, and vice versa.

L. Conclude this lesson by pointing out that the demand for a good - whether it be apples or gasoline - refers to the amount of that good that people are both willing and able to buy at various prices, other things being equal, during some particular period of time. Point out further that price has an important effect on the amount demanded. The lower the price, the greater will be the amount demanded. The higher the price, the less will be the amount demanded.

SUGGESTED EVALUATION STRATEGY:

1. Ask students to define demand.
2. Have students describe in writing or using diagrams how the amount demanded changes with change in price.

SPIN OFF

In this lesson students were introduced to the concept of demand. They learned about the relation between price and the amount demanded. To extend this lesson have them respond to the situations described on the handout "Scenes at a Hoosierland Service Station."

Note: A shortage is described in the first situation; a surplus in the second.

STUDENT HANDOUT

MY DEMAND SCHEDULE

Today's Date _____

PRICE PER APPLE	AMOUNT I WOULD BE WILLING AND ABLE TO BUY
50¢	_____
45¢	_____
40¢	_____
35¢	_____
30¢	_____
25¢	_____
20¢	_____
15¢	_____
10¢	_____
5¢	_____
1¢	_____

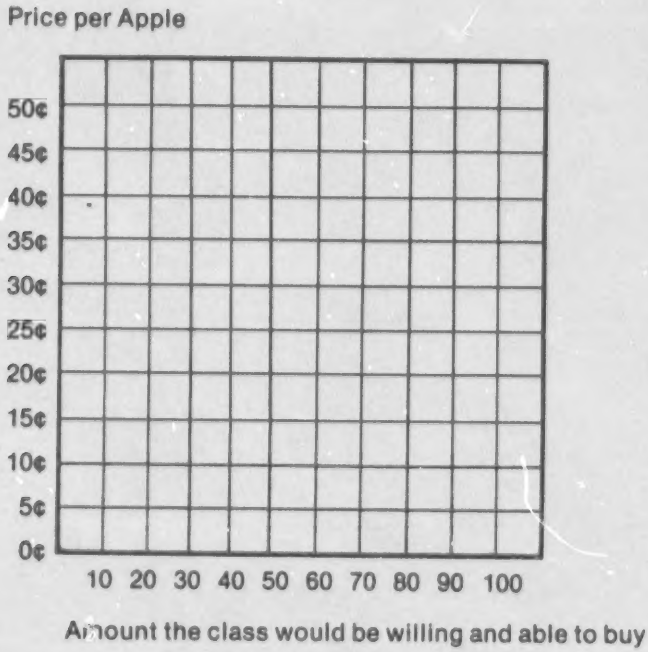
TRANSPARENCY
MASTER

CLASS DEMAND

TODAY'S DATE _____

Price per Apple	Amount the class would be willing and able to buy.
50¢	_____
45¢	_____
40¢	_____
35¢	_____
30¢	_____
25¢	_____
20¢	_____
15¢	_____
10¢	_____
5¢	_____
1¢	_____

TODAY'S DATE _____



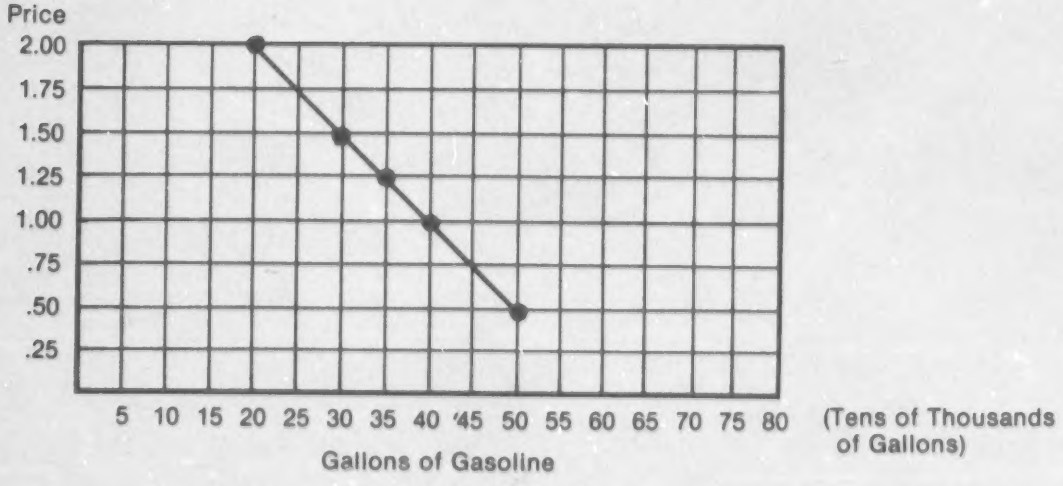
DEMAND FOR GASOLINE IN HOOSIERLAND
JANUARY 1, 1983

PRICE (PER GALLON)	AMOUNT DEMANDED (PER GALLON)
$2.00	20,000
1.50	30,000
1.25	35,000
1.00	40,000
.50	50,000

PART A: Fill in the blanks in the following sentences. Use the information above to help you. Also use what you know about demand.

The table above shows the demand for gasoline in Hoosierland on January 1, 1983. Demand refers to the _____ of a product, in this case _____, that people are willing and _____ to buy at various _____. The table says that if gasoline was offered for sale at $2.00 a gallon, the amount demanded would be _____ gallons. If the price was _____, the amount demanded would be 40,000 gallons.

DEMAND FOR GASOLINE IN HOOSIERLAND
JANUARY 1, 1983



Part B: Answer the following questions in the space provided: Use the information in the graph to help you.

a) How many gallons of gasoline would be demanded if the price was $.50 a gallon? _____

b) At what price would 35,000 gallons of gasoline be demanded? _____

c) As the price of each gallon went up, what happened to the number of gallons demanded? _____
_____

d) As the price of each gallon went down, what happened to the number of gallons demanded? _____
_____

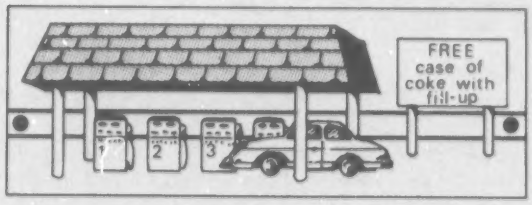
e) What general statement can you make about how the price of gasoline affected the number of gallons demanded?
_____
_____

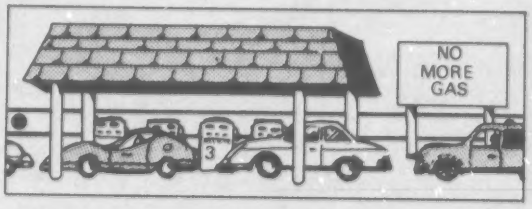
SCENES AT A HOOSIERLAND SERVICE STATION

Demand for Gasoline in Hoosierland
January 1, 1983

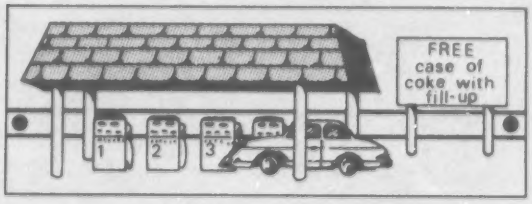
Price (per gallon)	Amount Demanded (per gallon)
$2.00	20,000
1.50	30,000
1.25	35,000
1.00	40,000
.50	50,000

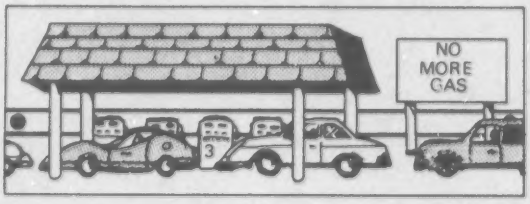
Situation One: On January 1, 1983, the price of gasoline in Hoosierland is set at $1.00 a gallon. At that price, service station owners offer 30,000 gallons of gasoline for sale. How many gallons would be demanded at the price? _____. Look at the following pictures. Which would better describe the scene at a service station in Hoosierland after gasoline had been selling for $1.00 a gallon for a while?





Situation Two: On January 1, 1983, the price of gasoline in Hoosierland is set at $1.50 a gallon. At that price, service station owners offer 40,000 gallons of gasoline for sale. How many gallons would be demanded at that price? _____. Look at the following pictures. Which would better describe the scene at a service station in Hoosierland after gasoline had been selling for $1.50 a gallon for a while?





FREE AND INEXPENSIVE RESOURCES ON ENERGY AND ECONOMICS

A NOTE TO TEACHERS

The Indiana Energy Information Center (IEIC) operates an energy information service which is available to all Indiana residents. The IEIC maintains, for dissemination, a wide variety of energy information and materials covering all topics on the following resource list. Single copies of these materials are free. For an IEIC publications list call the:

ENERGY HOTLINE
1 - 800 - 382-4631

or write the:

Indiana Energy Information Center
Division of Energy Policy
Indiana Department of Commerce
1 N. Capitol, Suite 700
Indianapolis, IN 46204

The IEIC Staff is "on-call" (via the ENERGY HOTLINE) to help Indiana residents with many kinds of energy questions. Speakers and other energy related services are also available through IEIC.

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COAL

*Edison Electric Institute
Educational Services
1111 - 19th Street
Washington, D.C. 20036

Coal: Answers To Your Questions. A 48-page booklet. #78-46. Sample copy free.

Keeping The Lights On: 1979 educational kit. Grades 5-9 #03-7925. Activity-centered program about coal and other energy sources. Includes six activity duplicator sheets and a teacher's guide. $3.20.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

Coal Pocket Data. Tables, charts, and maps of Exxon's coal operations, plus statistics on U.S. and world coal production. 399 pp. Free.

*National Coal Association
1130 - 17th Street, N.W.
Washington, D.C. 20036

Coal: a 24-page, illustrated reprint of The World Book encyclopedia article on coal. Grades 7-12. Single copies free.

Discovering Coal: A boxed kit, including filmstrip, cassette, eight activity masters, two fullcolor wall charts and teacher's guide. Designed for early elementary grades. $8.95.

The Power of Coal: A 20-page, two color booklet describing the beginnings, history, production and uses of bituminous coal. Designed for upper elementary grades. Includes activities for duplication and teacher's guide. Single copies free.

CONSERVATION

*Alliance to Save Energy
1925 K Street, N.W.
Washington, D.C. 20006

The 25% Solution: A 17-page booklet containing a dozen inexpensive ways to cut household energy use by as much as 25 percent. Single copies free; additional copies 25 cents each.

*American Petroleum Institute
Publications and Distribution Section
2101 L Street, N.W.
Washington, D.C. 20037

Energy Conservation Tips: Information on conserving our energy supplies. Includes conservation quiz, gasoline saving tips, guide to efficient energy use in the home, and tips on conserving energy in the kitchen. Single copies free.

*Association of Home Appliance
Manufacturers
20 North Wacker Drive
Chicago, IL 60606

Appliance Energy Conservation Tips: Series of tip sheets on how to conserve energy and save money through proper operation of home appliances. 25 cents.

*Channing L. Bete, Co. Inc.
200 State Road
South Deerfield, MA 01373

Energy Conservation Booklets: "The ABC's of MPG's," "Conserve Energy at Home" "Heating Your Home," "Save Energy," and "Shouldn't You Share a Ride." Single review copies free. Quantity pricing information available on request.

*Consumer Information Center
Public Documents Distribution Center
Pueblo, CO 81009

Find and Fix the Leaks: How to check for air leaks around your house and save up to 50 percent on your fuel bills. $2.50

In the Bank or Up the Chimney?: Illustrated how-tos for weatherstripping, caulking, insulating, etc. Worksheets for choosing methods of energy conservation for greatest savings. $2.00

*Edison Electric Institute
Educational Services
1111 - 19th Street
Washington, D.C. 20036

How to Save Energy With Better Use Habits: 1980, 18 pages. Conservation and energy management. Sample copy free.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180-Room 4187
Houston, TX 77001

Drive Like There's No Tomorrow: A booklet discussing the benefits of driving at 55 mph. Free.

Mickey Mouse and Goofy Explore Conservation: Comic book that can be used as an energy conservation teaching aid. Free.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

Energy Conservation: An Immediate and Reliable Alternative: 8 pages. Includes reading and reference lists. 25 cents.

*Tenneco Inc.
Public Affairs Department
P.O. Box 2511
Houston, TX 77001

The Fourth R: Resourcefulness in School Energy Conservation: A booklet used as a companion to Tenneco's film, "The Fourth R." Describes school energy problems and illustrates typical solutions. Free.

Something Special From Seed (Schoolhouse Energy Efficiency Demonstration): A 129 page report of 20 demonstration school energy audits conducted. Lists more effective energy saving recommendations. Contains energy audit survey for students and technical manual which serves as guide for school personnel to conduct audits in their own facility. Free.

Something Special for Teachers: Designed for teachers, the booklet includes: background on energy issues; an energy survey teachers and students can use to examine their own school; and, examples to help teachers "energize" existing curriculum. Free.

*U.S. Environmental Protection Agency
Office of Public Awareness
Environmental Research Center
Research Triangle Park, NC 27711

Get the Most from Your Gas Heating Dollar: Pamphlet answers the most commonly asked questions about the conservation, pollution, and potential safety hazards of typical gas-heating equipment. Free.

Get the Most from Your Heating Oil Dollar: Pamphlet providing information on cutting costs and reducing pollution by having oil burners serviced annually. Free.

ECONOMICS AND ENERGY

*Amoco Teaching Aids
P.O. Box 1400K
Dayton, OH 45414

The Mochan: For grades 7-12. Contains teacher's guide and ten student activity sheets illustrating economic concepts about the nature and mechanisms of the free market system. $1.00.

*Indiana Department of Public Instruction
Video Duplication Service
Room 229, State House
Indianapolis, IN 46204

The following video series are available to the schools of Indiana from the State Department of Public Instruction, Division of Federal Resources and School Improvement. There are no charges or fees for the series but schools are required to provide the blank video tape necessary to duplicate the programs. Schools may request series in any standard format -- 3/4-inch U-matic; 1/2 inch BETA; 1/2-inch open reel; 1/2-inch VHS -- but all blank tapes sent with requests for series should be clearly labeled with the school or school corporation's name as well as the specific series and program titles to be recorded on each tape.

Requests for any of the following series should be sent, along with the necessary blank tape, to the above address. For further information about the Video Duplication Service, call (317) 927-0393.

GIVE AND TAKE is designed to help junior and senior high school students increase their understanding of economic concepts and improve their decision-making skills as consumers, producers, and citizens. Each of the twelve 15 - minute programs dramatizes a problem-solving situation that shows students how economic concepts can be applied to areas of personal economics. Scarcity, personal decision-making, opportunity costs, consumer credit, productivity, human capital, derived demand, and career choices are just some of the topics covered in GIVE AND TAKE. The programs are open-ended to stimulate classroom discussion of the issues dramatized.

TRADE-OFFS is designed to improve economics instruction in United States and Canadian schools. This series of 15 lessons for children 9 to 13 will help students think their way through economic problems and increase their understanding of economics. On a broader scale, it will help them become more effective decision-makers and ultimately more responsible citizens. TRADE-OFFS is a comparison series to GIVE AND TAKE.

*Phillips Petroleum Company
Public Affairs
16 B4 Phillips Building
Bartlesville, OK 74004

American Enterprise: A series of five 28-minute films documenting our country's economic history. Teaching Guide. "Teaching Notes" newsletter. Permission available to educational institutions to duplicate at no charge on videotape. Films or videocassette available free on loan from two sources. Karol Media, 625 From Road, Paramus, NJ 07652, toll free phone (800)526-4773; and Modern Talking Picture Service, 5000 Park Street North, St. Petersburg, FL 33709, phone (813)541-6661.

*Standard Oil Company (Indiana)
Public and Government Affairs
Mail Code 3705, P.O. Box 5910-A
Chicago, IL 60680

The Kingdom of Mocha: Animated 16mm color film introduces economic concepts about the free market system in relation to the energy needs of society. Free on loan. Modern Talking Picture Service, 5000 Park Street, North, St. Petersburg, FL 33709.

ED 250 187 ENERGY AND ECONOMICS FOR THE ELEMENTARY GRADES. UNIT I (GRADES K-6). LESSONS AND ACTIVITIES FOR THE ELEMENTARY GRADES.

2 OF 2 BACKLER, ALAN INDIANA STATE DEPT. OF PUBLIC INSTRUCTION, INDIANAPOLIS. DIV. OF CURRICULUM. MAY 84 121P.

ELECTRICITY

*Edison Electric Institute
Educational Services
1111 - 19th Street, N.W.
Washington, D.C. 22036

Thomas Alva Edison: His Fertile Mind: 32-page booklet. #76 219. Sample copy free.

Electricity Serves Our Community: 1981, educational kit #03-078037. Grades K-6. Cardboard model of an electric utility system. Includes bulletin board cutouts, diagram for display, teacher guide. $4.50.

You and Your Electric Company: Answers to Your Questions: 36-page booklet. #78-47. Sample copy free.

ENERGY (General)

*Alliance to Save Energy
1925 K Street, N.W.
Washington, D.C. 20006

The Energy Puzzle: How You Fit In: A 32-page magazine reviewing the energy situation, with articles by nationally known writers. Single copies free; additional copies 25 cents each.

*American Gas Association
1515 Wilson Boulevard
Arlington, VA 22209

America's Changing Energy Story: #N81110. 1981. A 7½ minute, 48-frame filmstrip with cassette, suitable for general science and social studies classes at the junior and senior high school levels. Gives a broad overview of the energy picture in the U.S. today. $2.70.

*American Petroleum Institute
Publications and Distribution Section
2101 L Street, N.W.
Washington, D.C. 20037

Two Energy Futures: A National Choice for the '80s: 166-page book. Contains heavily documented chapters on oil and gas, coal, nuclear, synthetic fuels, access, environment and economic issues. Based on extensive survey of recent energy forecasts. First ten copies free; additional copies $2.50 each.

Energy in America: Progress and Potential: #877-15330. Examines America's recent energy progress. It also points out the continuing risk of oil supply disruption that underscores the need for further progress. 40 pages. First ten copies free; additional copies $2.50 each.

A Guide to State Energy Assistance Offices 1981-82: #806-09000. A state-by-state listing of low income energy and weatherization assistance contacts which provide funds and/or information to eligible families who may need help in paying their fuel bills or weatherizing their homes. Limited quantities available free.

*Atlantic Richfield Company
Speakers Bureau
515 South Flower Street
Los Angeles, CA 90071

Speakers: Available on a wide range of energy topics such as: Alaskan oil, offshore drilling, energy and economics and alternative energy sources like solar and coal. Speakers available in the following cities: Anchorage, Atlanta, Chicago, Dallas, Denver, Houston, Los Angeles, Louisville, Miami, Philadelphia, Pittsburgh, Tulsa, and Washington, D.C.

*Edison Electric Institute
Educational Services
1111 - 19th Street, N.W.
Washington, D.C. 20036

A Short Energy History of the United States...and Some Thoughts About the Future: Decisionmakers bookshelf series. 1980, 85 pages. $2.50.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

Middle East Oil: Second edition. The history of oil production in Middle Eastern nations, plus tables, charts, and maps. 39 pages. Free.

OPEC Questions and Answers. OPEC explained in layman's terms. 35 pages. Free.

Pocket Data. Useful statistics about Exxon and the energy industry packed in a tiny pocket-sized booklet. 39 pages. Free.

Pocket Position Book. Explains where Exxon stands on 37 different issues from federal leasing policy to national health insurance. Pocket-sized booklet. 39 pages. Free.

U.S. Energy Outlook: The nation's future energy needs and how they will be met. Compiled annually by Exxon planners to help guide the company in its business decisions. 16 pages. Free.

World Energy Outlook. A worldwide view of international energy supplies and demand. 40 pages. Free.

World Oil Inventories. The factors that affect international oil inventories. How world oil supplies are stored and distributed. 17 pages. Free.

*National Geographic Society
Educational Services
Department 82
Washington, D.C. 20016

Special Report on Energy. A 115-page special edition of National Geographic magazine devoted entirely to energy. Includes 12-page atlas of America's energy resources, history of energy crisis, proposed solutions. Copyright 1981. 1-9 copies, $1.45 each/10-99 copies, $1.15 each/ 100 or more copies $1.00 each.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

ENERGY (GENERAL) Cont.

Energy and the Sierra Club: A summary of Sierra Club energy policy. 15 pages. 40 cents.

*Sohio Film Library
2515 Franklin Road
Cleveland, OH 44113

Energy in Perspective: 16mm, 21-minute, color film. Thought-provoking film about energy. Discusses man's historic use of energy, examines the limits of the world's supply of fossil fuels, considers alternative sources of energy, and emphasizes need to turn from thoughtless over-consumption of the past to a more intelligent use of energy in the future. Produced by The British Petroleum Company Limited.

*Speak Out Sohio
Attention: V.F. Tizzano
1760 Guildhall Building
Cleveland, OH 44115

Two Energy Futures: Speakers available for classrooms, seminars, or workshops. Topics include energy outlook, energy economics, energy environment, and energy regulations.

*Texaco Inc.
2000 Westchester Avenue
White Plains, NY 10650

The Road to Energy, U.S.A.: 29 minutes, 16mm, color film. Shows that we're all on the same road together helping satisfy America's ever-growing energy needs. Film stars Bob Hope. Free on loan #31142 from: Modern Talking Picture Service, 5000 Park Street North, St. Petersburg, FL 33709.

*American Petroleum Institute
Publications and Distribution Section
2101 L Street N.W.
Washington, D.C. 20037

Looking for Energy? A Guide to Information Resources: #875-44000. A catalog listing various sources of energy information. Single copies free; additional copies 25 cents each.

Movies About Energy: #875-44500. A catalog listing energy-related films. Contains over 500 entries. First 10 copies free; additional copies 75 cents each.

*Amoco Teaching Aids
P.O. Box 1400K
Dayton, OH 45414

Energy Adventure: Grades 9-12. Contains a 28-page teacher's guide and student activity sheets. Resource reviews energy history, petroleum, natural gas, coal, electricity, alternative energy sources, and energy conservation. $1.

Living With Energy: For grades 7-12, and The Energy Crisis: for grades 4-6. Both contain an eight-page teaching resource with five duplicating student activity sheets that provide a variety of activities to study current energy sources, types, uses, and conservation. 50 cents each.

*Atomic Industrial Forum, Inc.
Publications Office
7101 Wisconsin Avenue
Bethesda, MD 20814

Audio-Visuals on Energy: A listing of films on general energy topics, nuclear energy, and supplemental energy sources. Up to three copies free.

*Center for Renewable Resources
Publication Department
641 South Pickett Street
Alexandria, VA 22304

Solar Energy Education Bibliography for Elementary, Secondary and College Students: This interdisciplinary bibliography covers selected solar activities, reading lessons, and background materials on sun, wind, water and biomass. February, 1980. 75 pages. $3.95 plus 15 percent postage/handling.

*Chevron U.S.A. Inc.
Public Affairs Youth & Education
P.O. Box 7753
San Francisco, CA 94120

The Energy Learning Center: Grades 5-8. Concerned with all aspects of energy resources, and with past, present and future uses of energy. Contains teacher's guide, spirit masters, and extensive bibliography. Free.

*Edison Electric Institute
Education Services
1111 - 19th Street, N.W.
Washington, D.C. 20036

Ethics and Energy: Decisionmakers Bookshelf Series. Softbound, 96 pages. #79-27A. $2.50.

*Education Commission of the States
Education Improvement Center
1860 Lincoln Street, Suite 300
Denver, CO 80295

Energy and Education: Planning for Higher Prices and Potential Shortages: Designed to inform education decision makers about major changes in federal policies addressing energy shortages, and the implications of these policies for state and local planning. Also management plans. Price and ordering information available from ECS.

Energy Education: A Policy Development Handbook: A booklet developed to help formulate appropriate and useful energy education policies. Free.

Energy Education: Why, What and How? Provides information about the content of energy education and implementation strategies. Free.

*National Association of Elementary
School Principals
1801 North Moore Street
Arlington, VA 22209

Schools Find Answers to the Energy Crunch: From Principal, Vol. 60, No. 4, March, 1981 - pages 23-5, by Roger Wall. $5.00.

*National Council for the Social Studies
3615 Wisconsin Avenue, N.W.
Washington, DC 20016

Teaching About the Energy Crisis: A special section of Social Education, edited by Judith Gillespie, April, 1980. $1.50.

Guidelines for Energy Education: Social Education, November/December, 1981. $5.00.

*National 4-H Council
Education Aids
150 North Wacker Drive
Chicago, IL 60606

Electric Energy Education Aids: Flier documents all materials available on electric energy. Free.

Energy Education Aids: Flier listing all energy and education materials available. Free.

Petroleum Power Education Aids: Lists materials available on petroleum power. Free.

*National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009

Playing With Energy: 106 pages. #471-14778. Classroom games and simulations for grades 9-12, selected from the Project for an Energy-Enriched Curriculum learning packet series. The games take important energy concepts and translate them into action, strategy, and fun for maximum student involvement. $5.00.

*Shell Film Library
1433 Sadlier Circle West Drive
Indianapolis, IN 46239

Shell Films: A catalog of films available. All films are available free on loan, with the understanding the user will pay return shipping costs and return prints promptly after showing.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

Information Services Literature List: Listing of Sierra Club publications available. Revised semi-annually.

*Standard Oil Company (Indiana)
Public and Government Affairs
Mail Code 3705, P.O. Box 5910-A
Chicago, IL 60680

Amoco Teaching Aids: A 5-page folder listing teaching aids available to help students understand basic economic concepts and energy-related needs, resources, and problems.

*The Standard Oil Company (Ohio)
Public Communications Department
1760 Guildhall Building
Cleveland, OH 44115

Energy Adventure: Teaching resource booklet containing useful background information and optional suggestions for classroom activities. Each activity in the teacher's guide corresponds to a spirit duplicating master. Includes 10 exhibits in the form of maps, charts, graphs and illustrations. Free.

ENERGY EDUCATION Cont.

*U.S. Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

Selected Department of Energy Publications: An annotated list of free booklets and curriculum materials currently available from the Department of Energy. Contains order blanks. Free.

ENVIRONMENT

*American Petroleum Institute
Publications and Distribution Section
2101 L Street N.W.
Washington, DC 20037

A Shore For All Purposes: #877-68070. This illustrated booklet is a summary of the Coastal Zone Management (CZM) Act of 1972, including the subsequent amendments of 1974 and 1976. The booklet focuses on the purpose of CZM and the reasons for its adoption as law. Free.

*Edison Electric Institute
Education Services
1111 - 19th Street
Washington, DC 20036

Before the Rainbow: What We Know About Acid Rain: Decision-makers Bookshelf Series. 1981, 108 pages. $2.50.

*Mobil Oil Corporation
Room 654G
150 East 42nd Street
New York, NY 10017

Health and the Environment: A 48-page booklet that examines environmental issues and describes steps Mobil is taking to assure employee health and safety, product safety and environmental protection. Free

*National Coal Association
1130 - 17th Street, N.W.
Washington, DC 22036

What Everyone Should Know About Land Reclamation: A 15-page two-color booklet describing land reclamation, its importance, how it works and the many uses for reclaimed land. Grades 4-12. Single copies free.

*U.S. Environmental Protection Agency
Research Summary Editor
Office of Research and Development, RD-674
Washington, DC 20460

Research Summary: Oil Spills: A brochure providing a brief description of major areas of EPA's research and development program. Free.

NATURAL GAS

*American Gas Association
1515 Wilson Blvd.
Arlington, VA 22209
(703) 841-8676

Please Note: Minimum order $5.00. Single copies free to teachers, courtesy of the local gas utility companies.

Energy Reports: A series of 4-page reports on various aspects of energy and the natural gas industry. (Inquire further regarding current titles) First 99 copies, 10 cents each; quantities over 100, 7 cents each.

History of Natural Gas: #N00430. Comic book giving the story of the gas industry past, present, and future. 1-4 copies, 7 cents each; 5 or more, 5 cents each.

Natural Gas Energy: #00585, 1982. For junior or senior high school. An illustrated booklet. Tells the story of natural gas - where it comes from, how it got there, and how much there is. Discusses exploration, transportation, distribution, storage, household and commercial uses, and by-products of natural gas. 75 cents each.

Natural Gas Serves Our Community: #N00160, grades 4-5; #N00170, grades 2-3. Cut-out kits of 28 pictures that describe the story of natural gas. Each kit contains booklet "N00165 or "N00175, which may also be purchased separately at 25 cents each. Kit, $2.00.

Properties of Gas and Heat Energy Experiments: #N00085. Elbert C. Weaver. Seventeen experiments on properties of gas and 14 experiments on heat energy. Prepared on spirit duplication masters for easy reproduction by teacher for student use. For junior and senior high school. $3.50.

Science Principles and Gas Appliances With Experiments: #N00500. Elbert C. Weaver, 1970. A 32-page booklet on science principles used in six gas appliances: range, home heater, water heater, clothes dryer, incinerator, air conditioner, with twelve classroom experiments. Materials for overhead projection and sample report sheet included. Grades 7-9. $1.60.

What Happens When You Turn On the Gas: #N00575. Arthur Shay, 1975. Grades 4-7. A 30-page book in the form of a LIFE magazine picture story telling the story of natural gas from the well to the user. 40 cents.

What Is Gas? #N00550. Elbert C. Weaver, 1972. A 45-page booklet with 12 demonstrations/experiments. How does a child learn about matter that exists in a gaseous state if it is colorless, odorless, tasteless, has little weight, and moves silently? The demonstrations/experiments suggest ways that some concepts about the world of gases may be developed. 4-6 grade teaching level. 60 cents.

NUCLEAR

*Atomic Industrial Forum, Inc.
Publications Office
7101 Wisconsin Avenue
Bethesda, MD 20814

Nuclear Energy Pamphlets: A series of pamphlets covering various aspects of the nuclear fuel cycle - how plants work, reactor safety, the use of uranium, etc. Up to 3 copies free.

Radiation...Naturally: 16mm, 28 minute color film which explores the world of low-level radiation - sources, applications, effects, benefits and risks. Available from: Modern Talking Picture Service, 5000 Park Street North, St. Petersburg, FL 33709, phone (813) 541-6661.

Reactor Schematics: Schematic diagrams of the four U.S. nuclear reactor types. Up to 3 copies free.

A Play Half Written: The Energy Adventure: A 16mm, 1979 color film celebrating the technological advances made possible through the use of energy, includes information about the importance of nuclear energy to the energy mix. A 1979 Cine Golden Eagle Award winner. The film is accompanied by a discussion leaders/teachers package. Free on loan: Modern Talking Picture Service, 5000 Park Street North, St. Petersburg FL 33709, (813) 541-7571.

*Edison Electric Institute
Educational Services
1111 - 19th Street
Washington, D.C. 20036

Nuclear Power in American Thought: Decisionmakers Bookshelf series. 1980, 92 pages. #01-070831. Book examines social, political, philosophical and psychological aspects of nuclear power in America. $2.50.

Nuclear Power: Answers to Your Questions: A 48-page booklet. #78-24. Sample copy free.

*Sierra Club
Information Services
530 Bush Street
San Francisco, CA 94108

Nuclear Power & the Sierra Club: 12 pages. Includes Sierra Club policy on nuclear power. Also includes bibliography. 40 cents.

Nuclear Wastes: Reprint from July/August 1979 issue of Sierra. 6 pages. 25 cents.

Nuclear Wastes - The Myths and the Realities: Reprinted from the July/August 1980 issue of Sierra. 4 pages. 20 cents.

PETROLEUM

*Alaska Pipeline Service Company
1835 South Bragaw Street
Anchorage, AK 99512

Operating the Trans Alaska Pipeline: A description of the pipeline and its operation. 22 pages. Free.

Operations Summary: A concise version of the pipeline operation. 16 pages. Free.

*American Petroleum Institute
Publications and Distribution Section
2101 L Street N.W.
Washington, DC 20037

Facts About Oil: #875-18700. An illustrated booklet containing statistical data and information on the various phases of the petroleum industry. Single copies free; additional copies, 75 cents each.

Gasoline for Your Car-Questions/Answers, Second Edition: #802-15800. This publication provides answers to questions frequently asked about gasoline and its principal quality features, octane, volatility, factors that influence knocking characteristics, various gasoline additives and their functions. 15 cents.

Know Your Motor Oil, Fifth Edition: #805-15070. Useful in educating car drivers on various practical aspects of motor oil and engine lubrication, 50 cents.

The Search for Offshore Oil and Gas: #862-60682. This booklet examines one of the sources for increased U.S. energy - the crude oil and natural gas resources underlying our coastal waters. Free.

*Channing L. Bete Co., Inc.
200 State Road
South Deerfield, MA 01373

ABC's of Oil: Booklet explains how oil is located, drilled, refined and transported. Single review copy free. Quantity pricing information available on request.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

The Offshore Search for Oil and Gas: The cost and rewards of finding and producing oil and natural gas underwater. Text, charts and maps. 38 pages. Free.

*Mobil Oil Corporation
Room 654G
150 East 42nd Street
New York, NY 10017

The New Science of Oil: A pamphlet containing a four part series of essays that describe the newest techniques for oil exploration and production. Free.

*Shell Oil Company
One Shell Plaza
P.O. Box 2463
Houston, TX 77001

The Story of Petroleum: A primer on the history and key functions of the oil industry - exploration and production, transportation, refining and marketing, and the manufacture and marketing of petro-chemicals. Free.

*Standard Oil Company (Indiana)
Public and Government Affairs
Mail Code 3705, P.O. Box 5910-A
Chicago, IL 60680

Catalysts and Crude: A 22-page booklet about petroleum refining. Free.

Oil In Depth: A 30-page booklet about petroleum exploration and production. Free.

*Sohio Film Library
2515 Franklin Blvd.
Cleveland, OH 44113

Pipeline Alaska: 16 mm, 28-minute color film. Tells the story of the trans-Alaska pipeline. Free on loan.

*Union Oil Company of California
Corporate Communications, Dept. A
Box 7600
Los Angeles, CA 90051

The Story of Oil: An illustrated wall poster featuring cartoon characters telling the story of oil from its formation to its many uses. Free (limit three copies).

*U.S. Environmental Protection Agency
Publications Office
401 M Street, S.W.
Washington, DC 20460

Unleaded Gas...The Way to Go: Pamphlet that answers the most commonly asked questions about unleaded gasoline. Free.

RENEWABLE ENERGY SOURCES

*Center for Renewable Resources
Publications Department
641 South Pickett Street
Alexandria, VA 22304

Solar Energy Education Packet for Elementary and Secondary Students: This packet of reading lessons contains plans for solar activities and background materials about all forms of renewable energy. Over 25 student projects. September, 1979. 64 pages. $4.25 plus 15 percent postage/handling.

*CAREIRS: Conservation & Renewable
Energy Inquiry & Referral Service
P.O. Box 8900
Silver Spring, MD 20907

Solar Bibliography: Bibliography of elementary through high school energy education materials. Free.

Note: CAREIRS also distributes literature and answers questions on the following topics: energy conservation, solar, wind, wood, bioconversion, alcohol, fuels, photovoltaics, solar thermal and small-scale hydropower.

*Consumer Information Center
Public Documents Distribution Center
Pueblo, CO 81009

Heating With Wood: Types of fireplaces, stoves and furnaces. Buying and burning wood efficiently and safely. $2.00.

Homeowner's Solar Sizing Workbook: How to select the most efficient solar heating system for your home. $4.00.

Wind Energy Information Directory: Lists of government offices, manufacturers/distributors, colleges and universities, computer programs, organizations, audio-visuals, books and periodicals. $2.75.

*Exxon Company, U.S.A.
Public Affairs Department
P.O. Box 2180 - Room 4187
Houston, TX 77001

Mickey Mouse and Goofy Explore Energy: Comic book characters lead a search through the ages for new sources of energy and better ways to use it. Free.

*Union Oil Company of California
Corporate Communications, Dept. A
P.O. Box 7600
Los Angeles, CA 90051

Geothermal Energy: A 12-page illustrated booklet explaining the harnessing of the natural heat of the earth. Available in classroom quantities to teachers. Free.

The Story of Geothermal Energy: An illustrated foldout poster showing how the earth's heat is being used to provide electrical energy. Limit three copies. Free.

SYNTHETIC FUELS

*American Petroleum Institute
Publications and Distribution Section
2101 L Street, N.W.
Washington, DC 20037

Supplementary Energy Sources: #877-69500. A booklet discussing the need to develop alternate fuels that could help America to meet its growing demand for energy in the future. Includes sections on coal, liquid fuel and coal, gas from coal, oil shale, tar sands, geothermal, nuclear, solar, biomass, wind, tide and ocean. Single copies free; additional copies 25¢ each.

*Channing L. Bete Co., Inc.
200 State Road
South Deerfield, MA 01373

Energy Sources Booklets: "About Coal," "Coal Gasification," and "Oil Shale." Single review copies free. Quantity pricing information available on request.

*Edison Electric Institute
Education Services
1111 - 19th Street, N.W.
Washington, DC 20036

Alternative Energy Sources - Answers to Your Questions: 1981. 52 pages. Sample copy free.

GLOSSARY

IMPORTANT ENERGY AND ECONOMICS WORDS

GLOSSARY

IMPORTANT ENERGY AND ECONOMICS WORDS

ATOM - The basic building block of all matter, an atom is the smallest particle of a chemical element (such as iron, hydrogen, gold or uranium) that still has the properties of that element.

BARREL - Although seldom put in actual "barrels", crude oil is measured in a unit called the barrel, equal to 42 U.S. gallons. One barrel of crude oil has the same energy as 350 pounds of coal.

BASIC ECONOMIC QUESTIONS - Every economic system must answer these questions: What shall be produced? How shall it be produced? How much shall be produced? For whom shall it be produced?

BREEDER REACTOR - A nuclear reactor that makes more nuclear fuel than it uses, by changing certain atoms that will not split into atoms that will split.

BRITISH THERMAL UNIT (BTU) - The amount of heat necessary to raise the temperature of one pound of water 1^{o} F.

CAPITAL RESOURCES - Goods such as tools, machines, or factories that are used to produce other goods and services.

CARTEL - An agreement among firms not to engage in price competition. Production quotas may also be set and penalties for violations agreed upon. Cartels are not legal in the United States.

COAL - A solid fuel, mostly carbon, formed from the fossils of plants living hundreds of millions of years ago.

COAL GASIFICATION - A chemical process to change coal into fuel similar to natural gas; the biggest advantage is that sulfur and other pollutants in coal can be removed before it is burned.

COAL LIQUEFICATION (COAL HYDROGENATION) - A chemical process to change coal into liquid fuels similar to gasoline and kerosene; compare with coal gasification.

CONSTANT PRICE - Current price adjusted for inflation.

CONSUMER - A user of goods and services to satisfy wants.

CONSUMPTION - Using goods and services to satisfy wants.

COOLANT - Anything pumped through a nuclear reactor to cool it or absorb the heat it produces. Common coolants are water, air, helium, and liquid sodium metal.

CRITICAL MASS - The smallest amount of nuclear fuel, like uranium, that will sustain a nuclear chain reaction of splitting atoms.

CRUDE OIL - Liquid fuel formed from the fossils of animals and plants at the bottom of ancient seas; petroleum as it comes from the ground.

CURRENT PRICE - The price that exists at a particular time, e.g., pump price for gasoline.

DEEP MINING - Mining that must be performed by digging underground shafts and tunnels.

DEMAND - The amounts of a good or service that buyers will be willing and able to purchase at each possible price at a given time.

DEMAND CURVE - The demand for a good or service shown graphically with price on the vertical axis and quantity demanded on the horizontal axis.

DEMAND SCHEDULE - A table showing the number of units of a good or service that would be demanded at various prices.

DIRECT ENERGY CONVERSION - The process of changing any other form of energy into electricity without machinery that has moving parts. For example, a battery changes chemical energy into electricity by direct energy conversion.

DIVISION OF LABOR - Breaking down work into different operations.

ECONOMICS - The study of the way scarce resources are allocated in order to satisfy wants. Economics looks at the way goods and services are produced, distributed and consumed.

EFFICIENCY - A measure of how effective an economy is in using resources to meet consumer demands for goods and services.

EFFICIENCY, THERMAL - A measurement of how efficiently any device changes heat into another energy form. For example, a modern coal-burning electric plant has about 38 percent thermal efficiency because just under 4/10 of the heat from burning the coal is actually changed into electricity.

ENERGY - The ability to do work or to make things move.

EQUILIBRIUM PRICE - That price at which the quantity of a good or service supplied by producers is exactly equal to the quantity demanded by consumers. (Also called market clearing price)

EQUITY - Fairness. In taxation, equal treatment of people with the same incomes and circumstances.

EXPORTS - Goods and services sold to foreign people, businesses, or governments.

FISSION - The splitting of the nucleus (or center) of one atom into two or more smaller atoms; fission often releases large quantities of energy.

FISSION PRODUCTS - The smaller atoms formed when atoms fission or split.

FLY ASH - Tiny particles of solid ash in the smoke when fuels such as coal are burned.

FOSSIL FUELS - Coals, petroleum and natural gas; this term applies to any fuels formed from the fossils of plants and animals that lived eons ago.

FUEL - Anything that can be burned or fissioned to produce heat energy.

FUEL CELL - A device similar to a battery in which fuels such as hydrogen gas or methane can be directly combined with oxygen to produce electricity and very little heat; the principal by-products of the process are water or carbon dioxide.

FUSION - The process of combining the nuclei or centers of two light atoms to form a heavier atom; fusion can release great quantities of energy. The sun produces its energy by fusion.

GAS COOLED REACTOR - A nuclear reactor that is cooled by a gas like air or helium, rather than by water or other liquid.

GASEOUS DIFFUSION - A process by which natural uranium is enriched and becomes a better nuclear fuel.

GEOTHERMAL ENERGY - Heat energy produced deep within the earth through hot rocks deep beneath the earth's surface.

GEOTHERMAL STEAM - Steam formed by underground water seeping through hot rocks deep beneath the earth's surface.

GOODS - Tangible products like cars, clothing, and food that can be used to satisfy human wants.

HORSEPOWER - A unit that measures the rate at which energy is produced or used. A man doing heavy manual labor produces energy at a rate of about .08 horsepower.

HUMAN RESOURCES - The contributions made by people to the production of goods and services. Mental efforts as well as physical efforts are included.

IMPORTS - Goods and services brought into a nation from other nations.

INCOME - Payments to people who supply productive resources and transfer payments. Payment may be made in money, goods, or services.

INPUT - Factor used in production. Land, labor, and capital are the most commonly used input classifications.

INTERDEPENDENCE - In a market economy, all prices are to some degree affected by all other prices. Specialization makes trade necessary and people depend on others for vital goods and services.

KILOWATT - A unit that measures the rate at which energy is produced or used. Ten 100-watt lightbulbs use energy at the rate of one kilowatt (equal to 1000 watts). A rate of one kilowatt maintained for one hour produces or uses one kilowatt-hour of energy (equal to 1000 watt-hours).

MAGNETOHYDRODYNAMICS (MHD) - Process that uses a magnetic field to produce electricity directly from the hot smoke and gases we get from burning fuels like coal and oil.

MARKET CLEARING PRICE - See equilibrium price.

MARKET ECONOMY - An economy where the basic economic questions of what, how, how much, and for whom are answered in competitive markets. Resources, goods, and services are allocated by the forces of supply and demand, which determine market prices.

MEGAWATT - Unit to measure the rate at which energy is produced or used; it is equal to 1000 kilowatts (see kilowatt).

MODERATOR - Material, such as water and graphite, used in a nuclear reactor to slow the speed of neutrons produced when atoms split.

MONEY - Anything that is generally acceptable in payment of accounts. Money in the United States consists of currency and demand deposits. (See also currency and demand deposits.)

MONOPOLY - A market situation with only one seller and no close substitutes for the product.

NATURAL GAS - Gaseous fuels formed from the fossils of ancient plants and animals; often found with crude oil.

NATURAL RESOURCES - Factors of production not created by human effort. Land, water, and ores are examples.

NATURAL URANIUM - Uranium as it is found in the ground; a mixture of two types of uranium atoms.

NEUTRON - A tiny particle, extremely heavy for its size, often found in the nucleus of an atom. Neutrons have no electrical charge, and are released when atoms split (fission).

NUCLEAR POWER - The energy produced by splitting atoms (such as uranium) in a nuclear reactor.

OIL SHALE - Rock formed by silt and mud settling to the bottom of ancient seas that contains a substance similar to crude oil. So-called shale oil can be removed from the rock by heating and then used to make gasoline, kerosene, etc.

OPPORTUNITY COST - What is given up by producing a good or service. It is also called alernative cost because resources used one way could have been put to alternative uses. Those uses are the opportunity cost of the choice that was made.

OUTPUT - The goods and services that result from using inputs in the production process.

PER CAPITA - Literally, per head. Whenever it is important to know what is available for each person in a society, per capita measures are used.

PERSONAL INCOME - The sum of wages and salaries, rent, interest, dividends, income of unincorporated enterprises, and transfer payments.

PETROCHEMICALS - Chemicals removed from crude oil at the refinery and used to make a wide range of products such as plastics, synthetic fibers, detergents, and drugs.

PETROLEUM - See crude oil.

PHOTOSYNTHESIS - The process by which green plants convert sunshine into chemicals.

PLUTONIUM - A heavy, man-made, radioactive metal that can be used for fuel in a nuclear reactor.

POLLUTION - Damage done to air, water, soil, and other natural resources.

PRICE CONTROLS - Temporary measures taken by government during periods of rapid inflation. During World War II, for example, the U.S. government set maximum prices on many goods and services.

PRICE INDEX - An indicator of the general level of prices. The three most important price indices in the United States are the Consumer Price Index, the Wholesale Price Index, and the GNP Deflator.

PRODUCER - One who creates goods or services out of productive resources.

PRODUCTIVE RESOURCES - Human physical and mental labor, raw materials, and capital. They are also known as factors of production.

PRODUCTIVITY - A measure of worker efficiency. Output per unit of input is the general measure used.

PROFIT - The difference between a firm's revenue and its costs. Economists include the opportunity costs of the business owner's labor and capital or normal profit as costs. Profit then is revenue over and above normal profit.

PUBLIC GOODS - Goods that cannot be kept from one person without being kept from all. National defense and flood control are examples of public goods. Since no private citizen could force others to pay for such goods, they would not be provided privately. Only the government can provide public goods because it can tax people to pay for them. Not all goods and services provided by government are public goods, because many of them could be provided privately.

RADIOACTIVITY - A spontaneous change in the nucleus or center of an atom, accompanied by the release of energy called nuclear radiation.

RATIONING - Allocating available resources, goods and services among possible uses and users. Market prices are one way of rationing. Government has intervened and used a system of ration coupons when the price system was seen as unfair.

REGULATION - Government control of the operation of privately owned businesses. Regulation may limit entry into an industry by requiring licenses, may set maximum prices for business like public utilities, or may control the operation of business as with safety requirements.

SCARCITY - The basic economic problem. Human wants are greater than the resources necessary to satisfy those wants.

SERVICES - Economic actions that satisfy human wants. The work of doctors, plumbers, and actors are services.

SHORTAGE - When the price of a good or service is set below the market clearing price, a shortage results. At the low price sellers will bring less to the market than buyers are willing to buy. The unavailable quantity is the shortage.

SOLAR ENERGY - The energy received from the sun. Nuclear and geothermal energy are the only presently available energy forms not derived from the sun.

SOLAR POWER - Electricity, heat, or other useful energy produced from sunshine.

SPECIALIZATION - When people, businesses, or nations produce those goods and services they are most efficient at producing, then trading their surpluses for the other goods and services they need.

STEAM ELECTRIC PLANT - An electric power plant (either nuclear or one that burns coal or other fuel) in which heat boils water into steam, the steam is used to turn a turbine, and the turbine turns a generator to produce electricity.

STRIP MINING - Mining for coal or useful ores by removing the soil and rock found above them, rather than by tunneling underground.

SUBSTITUTES - Goods and services that can be interchanged. When a price increase in one good causes an increase in demand for another good, the goods are substitutes.

SUPPLY - The relationship between market prices and what will be offered for sale at those prices. The amounts of a good or service that sellers are willing and able to offer for sale at each possible price at a given time.

SUPPLY CURVE - The supply for a good or service shown graphically with price on the vertical axis and quantity supplied on the horizontal axis.

SUPPLY SCHEDULE - A table showing the number of units of a good or service that would be supplied at various prices.

SURFACE MINING - A synonym for strip mining.

SURPLUS - When the price of a good or service is set above the market clearing price, a surplus results. At the high price sellers will bring more to market than buyers will be willing to buy. The unsold quantity is the surplus.

TECHNOLOGY - The combination of skills and knowledge used to produce a good or service.

THERMAL POLLUTION - Harmful effects to the environment that may be produced by the warm water released by electric power plants into nearby lakes, rivers, or oceans.

THERMONUCLEAR FUSION - See fusion.

TRADEOFF - What must be given up when an economic decision is made. (See opportunity cost.)

UTILITY - A measure of usefulness to a consumer. Much of economic theory relies on consumers' ability to rank their choices in order of their preference.

WASTES, RADIOACTIVE - A by-product of producing power by splitting atoms in a nuclear power plant; some of these materials are highly radioactive and stay radioactive for a long period of time.

WATT - See kilowatt.

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